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AN EMPIRICAL MEASUREMENT OF THE OPTION FOR THE POOR

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AN EMPIRICAL MEASUREMENT OF THE OPTION FOR THE POOR

by

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Dissertation

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Doctor of Philosophy

The University of Texas at Austin

December 2012

Dedication

To Anadelcarmen and Elizabeth.

Acknowledgements

I want to thank all those who have taught me to be concerned about the life condition of the poor, giving me a reason to be a sociologist. I am especially grateful to Bob Woodberry, who has been a teacher and a friend since I initially contacted the University of Texas. He has devoted endless hours to explaining, encouraging, editing, and sharing his research interests with me. I also thank Dan Powers, who, even with a full workload, kindly agreed to be my supervisor and has invested much time in revising my research design and results. Bob, Dan, and Tom Pullum helped me to understand and enjoy statistics by being patient, supportive, and generous with their time. I thank the scholars of the University of Texas, always supportive and helpful, particularly those who graciously agreed to be part of my committee. I also thank my friends from graduate school for sharing their knowledge and ideas—Celia Hubert in particular—and the research assistants who carefully helped me to acquire clean and consistent data. I thank those who generously shared with me their data and resources: the Office of Statistics of the Primate Archdiocese of Mexico (who shared unrestricted access to their digital data), the Centro Lindavista and the Mexican Episcopal Commission of Social Pastoral (who published working versions of the maps shown here and shared their data), the General Secretary of the Mexican Conference of Bishops (who collaborated in geo-coding churches), the General Vicariate of the Missionaries of Guadalupe, and the Pontifical Council for the Culture. I want to acknowledge that this research was possible as part of the Project on Religion and Economic Change supported by grants from the Templeton Foundation, Metanexus Institute, and Louisville Institute. Finally I deeply thank my family, whose support and patience has been crucial for getting this far.

AN EMPIRICAL MEASUREMENT OF THE OPTION FOR THE POOR

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The University of Texas at Austin, 2012

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This study links both census and religious service data, aggregating them at significant geographical levels. This makes it possible to test (1) if there is empirical evidence of the Catholic Church prioritizing the pastoral service to the poorest population of Mexico, and (2) if the results at different levels of analysis are consistent.

To answer these questions, I will introduce the analysis by an overview of the research and the conceptualization of poverty and the way the Catholic Church has faced this social condition, particularly in Latin America and Mexico. Following the overview, the research design is presented specifying research questions, hypotheses, data, and the procedures followed to process and analyze such data.

In my analysis I will present the geographical distribution of five dimensions of poverty in Mexico (deprivation of material goods, lack of running water, limited access to health services, illiteracy, and ethnicity) and the main indicator of pastoral services offered by the Catholic Church (number of parishes). Data from different sources will be linked and aggregated at different geographical levels through statistical and GIS platforms. Two main innovative tools to achieve this are the Areas of Direct Pastoral Influence (ADPI) and the Maximum Historically Consistent Geographical Units (MxHCGUs). These resources help to distribute and link socio-demographic and pastoral

data. ADPIs facilitate focusing on the detailed relationships whereas MxHCGUs can be re-aggregated to higher-level units of analysis. The analysis includes descriptive geo-statistical tools to identify geographic patterns and test for spatial autocorrelation. Negative binomial regressions test the correlation of poverty and pastoral services at different levels of aggregation of the data. Besides identifying the levels and dimensions of poverty where there is empirical evidence of the priorities of pastoral service, I address the consistency of the different geographical aggregations and explain the differences.

I emphasize the analysis of the levels of geographical aggregation directly relevant to the organizational structure of the Catholic Church: the ecclesiastical circumscriptions and the parishes. I will explain in detail the characteristics of both administrative-territorial levels and their importance in order to understand the provision of pastoral care. Although former sociological studies have never considered these levels in the study of poverty, they are the very units of aggregation used by the Catholic Church in pastoral strategies and decisions. Therefore, these are the most pertinent levels of analysis for a study about the priorities of pastoral services.

It should be noted that the main limitation of this research is the lack of longitudinal data that would be necessary to test causality. However, this study links these kinds of data for the first time and there is no source of more complete information: the data presented here are actually the basis for the official maps of the Mexican Catholic Church. Therefore this means a major advance in this kind of research. On the one hand, the dataset that I put together sets the basic structure to organize historical censuses and ecclesiastical data; on the other hand, although the results are limited to cross-sectional data, this exploratory step is crucial for my broader research agenda because this study will evaluate basic procedures that will enable the later incorporation and analysis of longitudinal data from more than 120 years.

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Chapter 1: Overview, Context, and Goals

The theological and pastoral statement of the "option for the poor" has spurred an increase in social scientists' interest in the Catholic Church in Latin America (Adriance, 1985; Bastian & Cunneen, 1998; Damacena Martins & Pedrosa de Pádua, 2002; Foroohar, 1986; Holden & Jacobson, 2009; Houtart & Lemercinier, 1983; Klaiber, 2009; Marin, 2010; Read, Monterroso, & Johnson, 1969; Sanders, 1970, 1982; Soares, 2008; Trejo, 2009). The intervention of the Catholic Church in the social sphere has raised questions. In the forty years since the appearance of official Catholic documents claiming a "preferential option for the poor" (CELAM, 1968, 1979, 1992, 2007) there have been efforts to sociologically interpret this religious phenomenon, but few approaches have evaluated the empirical—quantitative—implications, causes, and consequences of such religious assertions (Trejo, 2009). Despite the Catholic Church's potential role in alleviating poverty, no one has measured its presence among the poor.

The goal of this research is to accomplish a descriptive analysis of the location of poverty in Mexico—including dimensions of life quality, health opportunities, educational disadvantage, and the concentration of the indigenous population—at different levels of geographic aggregation, and the religious services provided in such areas by the Catholic Church. This is an empirical measurement of the relationship of the concentration of resources on behalf of the Catholic Church in relation to the geographic distribution of some dimensions of poverty in a Latin American country. This descriptive approach is the basis for a further longitudinal analysis of the relationship between religious activity and the life conditions of the population. For such broader research, there are detailed data available for recent years (directories, digital maps and data sets), but there are also fewer disaggregated sources from the end of the 19th century and for

the whole 20th century (censuses, year books). Therefore, I will also analyze the consistency of the results of my cross-sectional study when focusing on different levels of aggregation. This will highlight better ways for using aggregated data from older sources (1895 to 1980).

Mapping poverty and marginalization has recently been considered an important task in order to locate the most urgent challenges to improve the life quality of disadvantaged populations (Hentschel, Lanjouw, Lanjouw, & Poggi, 2000; Lanjouw & Özler, 2002; World Bank, 2004, 2007). Furthermore, mapping Catholic services is also important because of the role of the Catholic Church in Latin America. This organization arrived in the subcontinent with the first European conquerors and has always been the most extended and influential organization in the region (besides the state and the market). Actually, it was expelled from its former core site in society by the modern state and the capitalist market.

In terms of social assistance and social services, the Catholic Church has inspired and created more schools, hospitals, and social service centers than any other NGO in Latin America (Alcala, 1984; Hefferan, Adkins, & Occhipinti, 2009; Klaiber, 2009; Muriel, 1990; Penyak & Petry, 2009). Despite their interest in social work, the bishops and other main church leaders have usually kept good relationships with the political and economic powers (Holden & Jacobson, 2009; Houtart & Lemercinier, 1983; Penyak & Petry, 2009). Although ecclesiastic authorities in Mexico have more or less held critical positions against the government at least since the middle of the 19th century, the confrontation has not been about the population's life conditions but about the "rights of the church," or its capabilities to act and influence in the public sphere (Butler, 2009). Despite the intentions of the government to control the church's influence, the presence of the church throughout the history of the country is undeniable. Therefore, the Catholic

Church is commonly known in Mexico as THE Church, even in official government documents (Senado de la República, 2003), although the meaning and consequences of its presence have always been debated.

The social position of the Catholic Church has fluctuated throughout the more than five hundred years of its presence in Latin America, but two main phenomena have particularly affected the last fifty years. From the end of the 1960s, the Catholic Church has been using the expressions "[preferential] option for the poor," and less often—but more publicized—"liberation theology." The new or renewed interest in social problems has occurred in roughly parallel time to the increasing percentage of people converted to non-Catholic religious groups. The relationship between these two issues also challenges the understanding of the current place of the Catholic Church among the poor and marginalized (Trejo, 2009).

Therefore, the study of the Catholic Church in Latin America, and particularly in Mexico, in relation to its presence in poor and marginalized areas is relevant because of

- the historical role of the church and its influence and reach
- the salience of religious-based organizations (RBOs) and the importance of understanding contemporary civil society
- the study of religious competition
- the understanding of the Catholic Church as a paradigmatic organization that has remained present for several centuries whose geographic dispersion has not been studied in itself or in relation to other social phenomena

Now I will present a basic conceptual approach to different understandings of poverty, its measurement, and geographical representations that work as context for the study of the "option for the poor."

Chapter 2: Poverty

2.1 MULTIPLE DIMENSIONS

Understanding poverty and identifying actors involved in its potential alleviation are basic tasks for framing this research. Poverty is probably as old as human societies—at least after the primitive communism (if that ever existed). The concept is found in many classical sources of Western culture: the Old Testament presents strategies to make food accessible to the poor (Exodus 23:11), and Plato presents in Gorgias (477 b–e) an approach to understanding poverty as the vice in terms of property and explains that making money is the way to overcome it. Nevertheless, in the current literature the concept has far from a unique meaning. A recent study of documents authored in the last four decades by "donors, national governments, NGOs and researchers" identified at least 159 definitions of poverty "within the context of developing countries" (Misturelli & Heffernan, 2010: 37-38).

When classical economists looked for an understanding of the changes in early Western modernity, focusing on the improvement in production and life quality, they did not underline poverty, but richness, and "the causes of [such] improvement," as shown in the Wealth of Nations (Smith, 2005). The classic tradition, centered on the improvement, gained even more weight after World War II with the spread of the work of Walt Whitman Rostow (1953, 1959, 1960). The underlying idea is that once economic growth is achieved, poverty as an epiphenomenon will be defeated by the increase in well-being, or by the increased resources allocated "to social welfare and security" (Rostow, 1960).

The strategy progressively recentered on development, as the 2009 Annual Report of the United Nations Development Programme (UNDP) acknowledges: "Fifty-one years ago, UNDP's main objective was the provision of technical assistance and support in order to promote economic and social development in developing countries" (UNDP,

2009). The theoretical relevance of development compared to poverty can be appreciated by comparing academic journals: the University of Texas Library site displays over fifty journals that, having some perspective from the social sciences, include the word "development" in their names; but there are only fifteen journal names including "poor" and eight including "poverty."[1] The contrast is only partially representative of research concerns, because research papers about poverty are actually published in both kinds of journals.

Nevertheless, after all these years, productivity has not increased for the poor, (Haq, 1995) and development strategies haven't been satisfactory since the late 1980s (McNeill, 2007). Whereas economic development perspectives have not always emphasized social development, the recent emphasis on human development (HD) has been the key to shifting the perspective from targeting economic growth to focusing again on poverty. In the words of the UNDP, its own role as an international agency has evolved and is currently presented as the promotion of "pro-poor policies in the quest for human development" (UNDP, 2009). This human development (HD) is understood as:

> a process of enlarging people's choices and enhancing human freedoms and capabilities (the range of things people can be and do), enabling them to live a long and healthy life, have access to knowledge and a decent standard of living and participate in the life of their community and decisions affecting their lives (UNDP, 2009).

The first time the UNDP published the Human Development Report was in 1990 (UNDP, 1990); therefore, such an approach is relatively recent. The concept goes from a perspective centered in economic growth, to an approach considering human needs and being able to "bridge the gap between research and policy" (McNeill, 2007). It is a theoretically solid, meaningful and functional concept that has shaped the approach to

[1] Exercise performed in August, 2010.

economic and social problems and provides a way for understanding poverty. The concept of HD has both political and analytical acuteness, which has been somehow distorted by the World Bank when interpreted as “almost synonymous” with health and education.

One of the actual advantages of HD is the inclusion of multiple dimensions of human well-being. There are not only economic and sociological dimensions, but also psychological and philosophical—not devised from a limited metaphysical perspective, but from enriching multicultural experiences. So, there are ethical implications that are neither over-specified nor dogmatic (Alkire, 2002). If the goal is human development, we can reword it by stating that “poverty … is-to-be-reduced, and well-being … is-to-be-enhanced” (Alkire, 2002, p. 182). This is consistent with the fact that the multiple measurements and dimensions for the different definitions of poverty point to limitations in the quality of human existence, which remain even after different efforts to overcome them (Misturelli & Heffernan, 2010).

The understanding of poverty has gained complexity in the HD approach compared to a classical economical conception of poverty as limited monetary resources. Production and income have been easy to measure and compare; this accounts for their popularity among economists and other social scientists. From the HD perspective, those dimensions are not enough to measure poverty, although some way to measure poverty and compare between cases—or to evaluate programs—is still necessary. Thus, it becomes more and more common to address this by using more complex measurements than GDP per capita (Aristondo, de la Vega, & Urrutia, 2010; Bosmans, Esposito, & Lambert, 2011; Copestake & Camfield, 2010; Foster, Greer, & Thorbecke, 2010; Giordani & Giorgi, 2010). We should also be aware of the limits of measurement. In this context, not even the Human Development Index (HDI) has been designed as an

exhaustive measurement, given that it "cannot capture the breadth of the human development approach in general," because, "[n]o one number can, no matter how much we try to pack into that number" (Sen, 2006, p. 260). Instead of a complete measurement, the HDI ''was devised explicitly as a rival to GNP'' (Sen, 2006, p. 257), and to compete in similar uses HDI should be designed similarly to GNP per capita.

Poverty, now perceived as a multidimensional concept, has regained attention. Therefore, it is important to clarify what constitutes poverty in relation to such dimensions. In other words, we could think that poverty "consists of a lack of [economic] resources," and the symptoms are the different dimensions. From another perspective, we could think that "poverty consists of" the dimensions. Even more, we could think that one or more of the dimensions should be understood as the main cause(s) of poverty (Berthoud & Bryan, 2011). It seems that some perspectives point to the lack of resources as the definition, or one of the main causes, but multidimensional approaches actually argue for rising above this oversimplification and acknowledging that poverty is, itself, complex and multifaceted.

There have been different approaches to measuring multidimensional poverty. We should consider that these different alternatives in the literature provide us with a set of potential variables to be used in the test of the "option for the poor" in a multidimensional perspective. Some measurements include from six to twelve indicators of well-being (Alkire, 2002), whereas others include only a small set of variables, as the HDI does. But, even three elements are found more adequate than only income and/or consumption expenditure:

> The basic premise underlying the computation and publication of the HDI is that human welfare is not optimally measured by average income alone. The level of per capita income hides the distribution of income and poverty. It also excludes aspects of human welfare that lie beyond material wealth, in particular education

and health (Siggel, 2010).

This point is important, because this proposal plans to use census data which do not include income or expenditure. Such limitation is important, because some perspectives give a heavier weight to income than to any other dimension, as in the case of official measurements of poverty in Mexico (CONEVAL, 2009; Cortés Cáceres & Hernández Laos, 2002; Lustig, 1992). The problem we face is that we want to compare later data to historical data and we do not have survey data before the 1980s (INMUJERES, FLACSO, & Alianza Cívica, 2008). Therefore, I prefer to acknowledge the limitation and be able to eventually integrate into the analysis longitudinal census data focusing on some dimensions of poverty. Multidimensional approaches go further than income, and, in any case, income can be understood as one of the dimensions, which is usually correlated to the others.

To include other dimensions in the analysis, we can first consider that poverty is closely related to other concepts such as marginalization, exclusion, vulnerability, and inequality. A multidimensional approach usually includes these as dimensions, even if they could be analytically distinguished (Hopenhayn, 2003). Marginalization and exclusion are closer concepts among them and point to the need of inclusion. Vulnerability points to the risks and the correspondent inability to respond to critical situations. Inequality is particularly relevant because it points to the distribution of income and other resources (Parker & Pederzini, 2001; Post, 2001). In some cases the distinction has been central for the analysis (Yoshioka & Esparza Ochoa, 2009).

The sets of dimensions can be presented as open or finished lists. They can identify ‘‘basic needs,’’ in terms of biological and psychological referents, ‘‘basic capabilities,’’ in terms of social and political perspectives, or “basic reasons for action,” in terms of goals and values. They can depart from empirical research, from discursive

argumentation, or combine both perspectives (Alkire, 2002). The solutions presented to broaden the narrow economic vision have included "'external' things people should have or should be able to do," but "it can be argued that human well-being is at least as much about what people 'internally' think and feel about their life" (Copestake & Camfield, 2010).

The official Mexican multidimensional measurement of poverty is particularly important for this research. Mexico is a suitable example to analyze because of the persistent problem of poverty—despite the implementation of national and international strategies to overcome such a situation, but also because researchers have been constantly measuring poverty and evaluating such programs in recent times.

On the one hand, poverty has been a long running problem, despite the riches and resources of the country. The USAID profile for Mexico in May 2010 shows several programs supported and reports over 28 million dollars in USAID assistance for the year 2010, and over 120 million from 2006 to 2009. Nevertheless, the country "faces huge gaps between rich and poor, north and south, urban and rural. Over 40 percent of the country's population live on less than $2 per day while close to 18 percent live on less than $1 per day" (USAID, 2010). Official Mexican documents also acknowledge the necessity of strengthening and complementing social policies and programs in order to consolidate the current achievements in overcoming poverty (CONEVAL, 2009). This is still a challenge despite the progress in some dimensions of social development registered during the last decades.

On the other hand, Mexico has a solid infrastructure for measuring poverty and evaluating social policies. The National Council for the Evaluation of the Social Development Policy (Consejo Nacional de Evaluación de la Política de Desarrollo Social, CONEVAL) is a public office in charge of the evaluation of social development

programs and policies and responsible for the measurement of poverty (LGDS, 2004).

CONEVAL, from its origins, has considered the multidimensionality of poverty, but the measurements used to be limited to economic poverty (income). There were three defined levels in the measurement (CONEVAL, 2007b):

- Food poverty (insufficiency to cover the estimation of basic food)
- Capacity poverty (the former level plus the insufficiency to cover the estimation of health and education)
- Patrimonial poverty (the former two levels plus the insufficiency to cover the estimation of clothing, housing and transportation)

In the end the three levels measure income poverty.

Nevertheless, CONEVAL recently published a methodology for measuring multidimensional poverty (CONEVAL, 2009, 2010a) considering the eight dimensions enunciated by the law (LGDS, 2004):

- Per capita income
- Average educational disadvantage
- Access to health services
- Access to social security benefits
- Housing space sufficiency and quality
- Access to basic housing utilities
- Access to food
- Degree of social cohesion

The document acknowledges the challenges of a complex measurement, and of the periodicity and disaggregation of such a measurement. In CONEVAL's perspective, poverty is associated with life conditions damaging human dignity, limiting basic rights and freedoms, and impeding both the fulfillment of basic needs and the full social

integration (CONEVAL, 2009, p. 7; 2010a, p. 25). Therefore, measurement cannot be limited to the individual, but should include contextual aspects such as geographic, social, or cultural characteristics. They identify three analytical areas in the listed dimensions: well-being in terms of commodities (number 1), fundamental social development rights (numbers 2 to 7), and relational and community issues linked to a territory (number 8).

A person is in a multidimensional poverty situation if he or she does not have enough income and at least one of his/her social development rights is not guaranteed (CONEVAL, 2009, pp. 20, 113). Therefore, there is a double threshold to determine if someone is poor. We find two boundary lines: a well-being line in terms of income corresponding to the more traditional poverty line, which means that someone cannot pay for the basic commodities and services; and a deprivation line in terms of social development, which means the lack of at least one of the social development rights. People in extreme poverty are a subgroup located inside two other boundaries: in terms of income they cannot even afford their food, and in terms of social development they lack three or more social rights. We can graphically observe this in Figure 1.

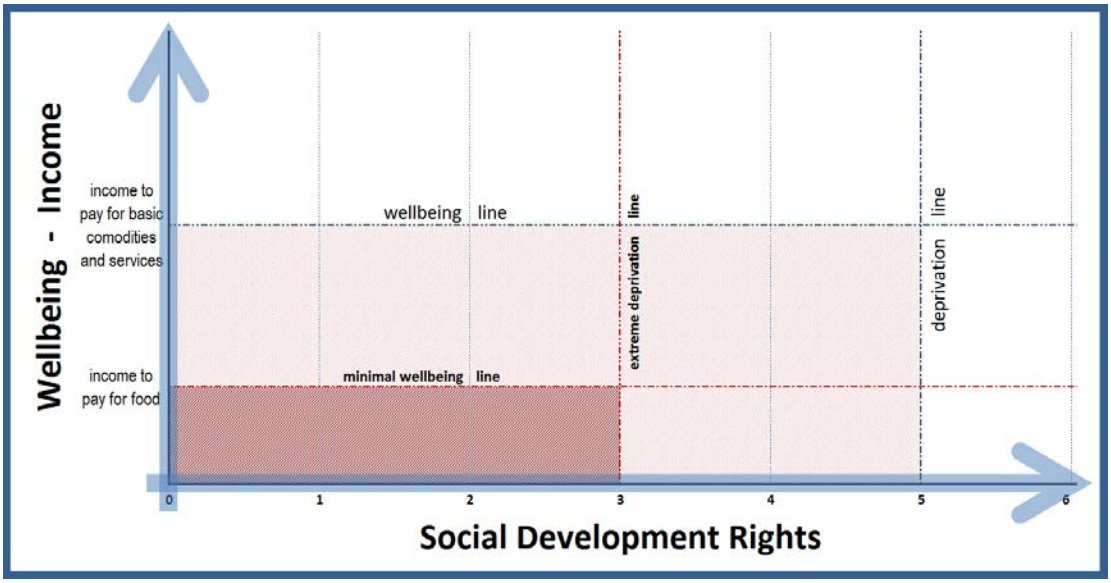

Figure 1: Multidimensional Poverty.

Following the different categories to classify population, CONEVAL will report the following thirteen indicators (CONEVAL, 2009, p. 27; 2010a, p. 44):

1. Population with an income lower than the well-being line
2. Population with an income lower than the minimal well-being line
3. Population with educational disadvantage
4. Population not having access to health services
5. Population not having access to social security benefits
6. Population not having sufficiency and quality in housing space
7. Population not having access to basic housing utilities
8. Population not having access to food
9. Population lacking one or more social development rights
10. Population lacking three or more social development rights
11. Population in multidimensional poverty
12. Population in extreme multidimensional poverty

13. Population in moderate multidimensional poverty (added in the 2010 version)

CONEVAL measures the depth of poverty using the Foster-Greer-Thorbecke (FGT) method (Foster, Greer, & Thorbecke, 1984; Foster et al., 2010) considering the distance from the poverty line to the average income of the population under that line. The index of social deprivation, or the depth of deprivation, is shown by the number and average proportion of the population lacking social rights.

Social cohesion refers to territorial context and is estimated from the Gini index, the degree of social polarization, the income rate of population in extreme poverty compared to non-poor population, and the index of perception of social network.

Notice that Mexico has a legal corpus acknowledging multidimensional poverty and requiring the correspondent measurements. Nevertheless, the measurements had not been presented with such detail at the level of municipalities (CONEVAL, 2007a, 2008) until the most recent measurements (CONEVAL, 2010b). The original official perspective had given more weight to the economic resources, which are the only aspect formerly considered to measure well-being. However, the most recent dataset available (CONEVAL, 2011) includes multidimensional measurements at the municipality level.

With such a complete measurement, it is interesting how the approach has not included any ethnic dimension. This is an important issue because ethnic and racial discrimination limit access to services, information, and equal treatment and opportunities (OPS, 2001). Scholars talk about the process of indigenous segregation and self-marginalization, which creates health problems because of limited resources and stress (C. Torres, 2001). Since colonial times, indigenous peoples have been so excluded from social, cultural, and economical advantages, that today it is difficult to identify the causality direction between poverty and discrimination. In colonial Mexico the use of the word *indigenous—indio* or *indígena*, in Spanish—ignored the ethnical differences among

groups and evoked the negative characterization common to other contexts of racial discrimination: they are savage, lazy, superstitious, etc. (C. Torres & del Rio, 2001).

In the colonial practice, there were several ways of discriminating and exploiting the indigenous population, even against some good will present in the official legislation (Leyes de Indias, 1680). The colonial practice of discriminating—distinguishing and separating—remained after independence. The indigenous peoples were considered inferior by the white population, who had economic and political power. Formerly considered as part of the property of the *haciendas* or the mines, the indigenous peoples were still relegated to low prestige employment and had minimal salaries, if any. When configuring the new nations, the goal of a culturally unified nation-state again restrained the possibilities of indigenous cultural reproduction. The subordination mechanism all over Latin America included, in general terms, the limitation of rights, deprivation of production means, lack of political representation, and cultural destructuration. Even social work, such as that of the hospitals—which I will present later—were mostly insensitive to ethnic identity, discouraging indigenous peoples from taking advantages of Western medicine (C. Torres & del Rio, 2001). Something similar also happened in the religious sphere: the Catholic Church defended their dignity, but was also suspicious of their way of living and religious practices, because indigenous groups had religious beliefs and practices that combined the imposed Catholicism with their own ancestral religious systems.

Indigenous populations live not only poor, but in extreme poverty: in Mexico over 60% of the indigenous are poor. In the 1990s 50% of indigenous households did not have electricity, 68% did not have running water, 90% did not have drainage systems, and 76% had dirt floors. Indigenous populations usually show bigger educational disadvantage, since they have not been really incorporated into the education system: in

Mexico, indigenous areas could have two or three times the illiteracy rate of other areas (Hopenhayn, 2003). The problem comes not only from lack of access, but also from pedagogical appropriateness, because multicultural and bilingual education has been considered only in recent decades.

We can observe that being indigenous is highly correlated to poverty, low living standards, health problems, and educational disadvantages. Indigenous tradition and identity have been rarely appreciated. They have mostly been ethnically, culturally, and socially marginalized all over Hispanic America (Holden & Jacobson, 2009; Hopenhayn, 2003; OPS, 2001). The decomposition of multilevel poverty shows large differences by ethnic groups; therefore, such "groups are clearly a key variable to consider in analyzing the causes of and responses to multidimensional poverty" (Alkire & Santos, 2010a). These group differences should be studied in detail. Furthermore, some authors have considered that poverty can be studied "from an ethnic perspective" (Gonzalez de Alba, 2010; Hopenhayn, 2003; Yoshioka & Esparza Ochoa, 2009). In terms of the missing dimensions of multilevel poverty, ethnicity seems to be linked to shame and humiliation (Alkire, 2007; Zavaleta Reyles, 2007, 2009). Therefore, like gender, ethnicity has also been identified as a dimension of poverty (Kazemipur & Halli, 2001; Revenga, Ringold, & Tracy, 2002; von Gleich & Gálvez, 1999). We should remember that horizontal inequalities, or inequalities among groups, have been sometimes ignored in the research and policies (Stewart, 2003), but they actually persist because they also are multidimensional (Stewart & Langer, 2007).

The measurement of the indigenous condition has been debated in Latin America, since it is not common to ask for race or ethnicity in surveys or censuses. The necessary conditions to be considered indigenous are historic roots and different culture, although the sufficient condition is the self-identification. Nevertheless, the identification is

usually achieved by asking if someone speaks an indigenous language. It is interesting that one methodological limit to include ethnicity in former poverty studies in Mexico was also linked to the unavailability of this variable in surveys. But the National Household Income and Expenditure Survey in its 2008 wave included a question for indigenous language use. This made possible the comparison of indigenous with non-indigenous populations at the household level. As a result, we observe the correlation of being indigenous and having low income, net of other variables (Gonzalez de Alba, 2010).

We have considered multiple dimensions of poverty which could be integrated in testing empirical evidence for the option for the poor. The next step is to evaluate advantages and disadvantages of geographically locating different dimensions.

2.2 MAPPING POVERTY

In order to test if the poor—or the areas they inhabit—are recipients of preferential pastoral services, they will be identified and geographically located. This "spatial description of the distribution of poverty" is currently known as a poverty map (Lanjouw & Özler, 2002), which "is essentially a geographical profile of poverty, indicating in which parts of a country poverty is concentrated" (Hentschel et al., 2000). The elaboration of poverty maps has been pretty recent (Elbers, Fujii, Lanjouw, Özler, & Yin, 2007; World Bank, 2007), particularly compared to the debate on poverty. Maps have been made more accessible thanks to Geographic Information Systems (GIS), which provide a digital infrastructure to build them (Bedi, Coudouel, & Simler, 2007b). There is not much debate in the literature about poverty maps, probably because they have been developed in a technically oriented environment and they have not been available for a long time. Thus, we usually find agreement about both their use and the procedures for

making them.

There is an improved ability to map—and geographically monitor—poverty and its causes. Thus, we can better understand them and plan more focused strategies and policies (Elvidge et al., 2009). Through the maps, researchers can pay attention to spatial patterns of poverty and inequality, and compare different areas. The level of geographic disaggregation is crucial in order to achieve good results, since "aggregate, national level indicators often hide important differences between regions or areas" (World Bank, 2004). Subnational levels could be regions, states, districts, municipalities, and even cities, towns, villages or neighborhoods. Spatial disaggregation is a key element of modern poverty maps, together with the possibility of simultaneously showing different variables (dimensions of poverty, influential factors, correlates, consequences, etc.). Besides, for practical reasons, it is easier to start from a detailed spatial disaggregation to re-aggregate into bigger units for the analyses.

Maps have advantages in terms of analysis, policy design, and communication. The main advantage is that images help to understand and explain the mechanisms associated with poverty. Therefore, maps complement some statistical analyses. But maps also provide elements for a more complete analysis: some variables depending on climate and geography can be easily integrated in the analysis. It is also easier to account for infrastructure in terms of distance to transportation networks such as roads, railways, etc., or to significant places and services such as medical facilities, schools, markets, etc. (Bedi et al., 2007b). Maps also facilitate the utilization of geo-statistical techniques which require complex measures of contiguity or proximity. The second main advantage is that detailed analyses lead to focused policies and interventions for short-, middle- or long-term alleviation of poverty (Lanjouw & Özler, 2002). Particularly in poor countries, the maps have an important role in the allocation of resources (Hentschel et al., 2000). Thus,

maps favor the tasks from the arrangement to the evaluation of programs and policies. The third main advantage of maps, in terms of communication, is their legibility:

> Maps are powerful tools for presenting complex information in a visual format that is easy to understand. They can summarize multiple dimensions in a simple display, something difficult to do otherwise. … Maps encourage visual comparison and make it easy to look for spatial trends, clusters, or other patterns (World Bank, 2004).

A map can display a summary of thousands of units of observation together and represent some spatial relationships among them in a single image (Bedi et al., 2007b). This can even favor agreements about the meaning and inclusion of different dimensions of poverty.

The inputs for the maps come from the main sources for socioeconomic information, which are censuses and household surveys (Demombynes, 2002; Elbers et al., 2007; Elbers, Lanjouw, & Lanjouw, 2002a, 2002b; Hentschel et al., 2000; Lanjouw, 2003; Lanjouw & Özler, 2002; World Bank, 2007). Surveys usually have more detailed figures on several dimensions of life quality, and even values and perceptions, including data on income, expenditures, and consumption. They can also include detailed data on health and education. Due to their depth, surveys require a major expenditure of time and money. Because of that, they usually cover a relatively limited sample of individuals or households, and are only representative for some levels of aggregation. Censuses focus on the whole population—not only on a sample—and can be aggregated at any desired level, but they are not that detailed nor frequent. Census waves include periodical measurements along time, making possible longitudinal analyses of longer periods when variables are relatively coincident among different waves. A third kind of information suitable to be used is the data systematically gathered by administrative units at different levels. These data are particularly important in terms of official policies and

interventions, and come from both governmental and non-governmental offices, although only few non-governmental organizations can have a wide scope for gathering data.

On the one hand, household surveys have the most detailed information available for measuring poverty—including multidimensional measurements—but they are not usually representative at small levels of aggregation. On the other hand, census data do not include enough information on life quality.

Therefore, we usually find a tradeoff "between size and quality" (Hentschel et al., 2000), that is, "between the number of observations in a data set and the information content, because collecting a lot of information for a very large sample is prohibitively costly" (Lanjouw & Özler, 2002). Thus, the first limitation of poverty maps is the cost of the basic data (Elvidge et al., 2009). To face this, the usual procedure is the estimation of poverty indicators for small geographic units of observation from the combination of survey and census data, taking advantage of the strengths of each one of them (Demombynes, 2002; Elbers et al., 2007; Elbers et al., 2002a, 2002b; Hentschel et al., 2000; Lanjouw, 2003; World Bank, 2004, 2007). The first step is the identification of the variables included in both the census and the survey. Those predictors are used to model the variable(s) of interest. This has been done using "empirical Bayes and best linear unbiased prediction models" (Lanjouw, 2003). The coefficients, the spatial relationships, and the errors, are used to get detailed predicted values—which can be aggregated at the desired level. The results are adjusted to correspond to the geographic units of observation, which can be represented by the survey itself. The method has been considered statistically reliable in several developing countries.

When the data from survey and census correspond to the same year, we can assume the validity of the estimation. As the time gap between both sources increases, the assumption becomes more difficult to sustain, particularly if we know of important socio-

demographic changes, or any other relevant event, during the gap (Lanjouw, 2003).

Another important challenge is having access to the data, particularly to the census data sets, since the information is considered sensitive in terms of the privacy of the population (Bedi, Coudouel, & Simler, 2007a). For example, in the case of Mexico, the researchers report that "the Ministry of Social Development and INEGI negotiated for almost 18 months to determine procedures so that the team would be able to exploit the census" (López-Calva, Rodríguez-Chamussy, & Székely, 2007, p. 194), because INEGI usually makes available only tabulations and aggregated data. Therefore, this issue should be carefully considered and planned for.

Once data are accessed and the maps done, we should still consider other limitations to avoid misusing them (Bedi et al., 2007b). Maps are based upon data, and their accuracy then depends upon which data is used. Problems should be addressed before using the data. When combining census and survey data, a main concern should be the correspondence of both sources to guarantee the validity of the estimated values. It is necessary to be careful about every detail and analytical decision, looking for the best way of calibrating the models and considering the errors and their distribution. Besides, when there is great inequality inside the units of analysis, the identification of poorest areas cannot be very effective. Since the map can include different dimensions of poverty, it is important to notice that they are often correlated, but not usually reducible to each other. When mapping other variables, we should remember that correlation is not sufficient to prove causation, and that there is need of broader analytical and theoretical work to identify possible causes of poverty. We should also be aware of the effective life of poverty maps. They help us to understand the appropriate context, particularly in terms of time, but mapping should be a continuous exercise of updating information through time.

Maps are commonly designed over the software infrastructure of Geographic Information Systems (GIS). This makes it possible to directly integrate satellite data (Elvidge et al., 2009), but most commonly they start from usual survey or census data sets. The Project of Religion and Economic Change (PREC), which includes the research presented in this document, has major innovations in terms of linking different kinds of data (Woodberry, Esparza, Porter, & Lu, 2010). Each piece of data can be referred to some geographic unit of observation, but for the different maps the information should be summarized according to different geographic units of analysis. Some data are given according to territorial units or polygons (areas of administration or livelihood), some according to exact locations or points (services, schools, health facilities, churches, etc.), some according to networks or polylines (infrastructure of communication, gas, electricity, etc.). Graphically, the data can be represented as discrete units (points, lines, areas), or by grids or cells in a continuous space (Bedi et al., 2007b; Woodberry et al., 2010).

There are data on location and on other variables corresponding to each unit of observation and these units are more or less interchangeable in terms of representation. Each polygon can be represented by a point (either its geographic center, i.e., centroid or its center of administration: the capital, county seat, or bishop's see), or it can be represented roughly as a group of cells. Each point represents a polygon (e.g., a village or city) and can fit inside either a polygon or a cell. Each cell can be represented by a point (its centroid) and can fit inside polygons (most easily by determining the polygon that its centroid fits inside).

The first step in linking data is to relate units of observation within their types, i.e., points with points, cells with cells, and polygons with polygons. This is the procedure followed in every poverty map having more than one source. When we have

the same units in two datasets, we still can have different names for each unit. When linking longitudinal data, locations will have even more differences in the name through time. Without linking points, overlapped maps look like a set of shotgun blasts and give a false impression of movement over time. In order to link areas, we must standardize data from different sources to the same level of rounding or aggregation. We then link features of the same "size" through a unique ID. Poverty maps also link polygons of different size, but usually one set represents a subdivision of the other set. In such a case the challenge is finding the correspondence. When dealing with borders only partially coincident, we can follow the method of Maximum Historically Consistent Geographic Units (MxHCGUs), as will be described in the methods section.

Once all the data are distributed at the same, and minimal, units of observation, we can aggregate them according to any larger geographic units of analysis. The spatial linking approach followed in the PREC also has advantages for mapping, particularly when dealing with longitudinal data and not-perfectly-coincident borders. MxHCGUs can be aggregated for any level of analysis, and can be dissolved—joined together through a GIS procedure—for geographical representation. If we eventually find a more accurate version of one of the borders, we merely change one line on our base map, and we can update all the borders of our units of observation automatically. We then rerun the scripts that link point and centroid data to the MxHCGUs, and our data are properly linked again. Similarly, if we add a new border, for example, dividing one MxHCGU into two, we replace the old unique ID with two new ones and rerun our scripts linking other data to these MxHCGUs. Thus, with relatively little work, all of the maps and data linking in the database can be updated. The method also has advantages for spatial distribution of the data, statistical analysis, and multiple imputation techniques (Woodberry et al., 2010).

In Mexico we find a recent but significant tradition of mapping poverty

(CONEVAL, 2007a, 2008). Using combined information of survey and census, the government has developed plans

> to reduce poverty and promote human development by focusing on the 50 municipalities with the highest poverty rates and the lowest human development indexes. Seven ministries operating 12 different but related programs now focus as a priority on the poor in these 50 municipal areas. These seven ministries have had to coordinate the 12 programs to meet the targets set out in the plan (Bedi et al., 2007b).

Mexican poverty maps have used separate indicators to measure human development and different dimensions of poverty, but the traditional source for measuring poverty is the National Household Income and Expenditure Survey (Encuesta Nacional de Ingresos y Gastos de los Hogares), which was first carried out in 1984, then in 1989 and every two years from 1992 (López-Calva et al., 2007). Its goal is to gather information on the distribution, amount and structure of income, and expenses of households. The survey differentiates on the sources of income and different kinds of expenditures, also gathering socio-demographic characteristics and infrastructure and services of the housing facilities (INEGI, 2008b). For the year 2000, researchers identified some variables which were present in both the survey and the census, and were conceptually as much as statistically comparable. These include some housing characteristics (in terms of services, construction, etc.), household appliances and equipment (such as televisions, phones, refrigerators, cars, etc.), labor characteristics (employment, hours worked, etc.), and socio-demographic characteristics (sex, age, marital status, etc.). I have already mentioned that the wave of 2008 finally included a question for indigenous language use (Gonzalez de Alba, 2010).

Thanks to the effort invested in poverty maps, they have enlightened social policy design and implementation, as well as the communication between government and civil society, and the results have been more generally accepted and used. My effort is thus in

debt to the former maps of poverty in Mexico, and this research expects to contribute to that field.

We have basically considered different ways for understanding and representing—mapping—poverty. The remaining framework will be completed with a description of how poverty has been understood and addressed by the Catholic Church in Latin America in general, and specifically, some particular characteristics of Catholicism in Mexico.

Chapter 3: The Catholic Church and the Poor

The Catholic Church can be understood from many different perspectives, which will lead to different strategies and conclusions in a research project. As a social actor, the Catholic Church offers various services and cultural products that could be understood as part of its pastoral work. The activities of the church have many complex dimensions, and they influence the social environment in different ways. In the Latin countries of the Americas—Spanish and Portuguese speaking, with a historical Roman Catholic majority—this religious issue has additional social relevance. Therefore, for understanding the preferential option for the poor in terms of pastoral service, we need a trans-disciplinary approach. Such an approach includes basic theological contents that will make it possible to be aware of how the organization understands its own work and its own priorities. A proper understanding of the pastoral preferential option for the poor acknowledges that the mere wording is a theological construct that should be located in a particular historical context. Although this chapter will not be enough to present a complete trans-disciplinary approach—because of time and space—it will offer a minimum framework for this study.

3.1 Pastoral Work: Theological and Organizational Understanding

The Catholic Church understands itself as a society "constituted and organized in this world" governed by the pope and "the bishops in communion with him" (C.I.C., c. 204). As a society, the church understands itself as a divine institution that "is in Christ like a sacrament, or as a sign, and instrument, both of a very closely knit union with God and of the unity of the whole human race"; it considers that, "[t]he present-day conditions of the world add greater urgency to its mission" (Lumen Gentium, n. 1). This mission is "to proclaim and to spread among all peoples the Kingdom of Christ and of God and to

be, on earth, the initial budding forth of that kingdom" (Lumen Gentium, n. 5). But there is not a fixed understanding of this mission. There is not even a unique understanding—among Christians—about Christ, God, or the Bible. The meaning is actually understood in different ways throughout history and places. In other words, interpretation has always been part of Christian history and it is explicitly admitted in the Catholic tradition. Theology actually means theologies: there have been different reflections from the faith to understand the Bible, the church and the historical context.

For example, the Catholic perspective considers that it is possible to find a more comprehensive or complete understanding of the meaning of a biblical text (*sensus plenior*) than the meaning that the human author had in mind in his time. The issue of interpretation is important when considering the possibilities of change in the church as an institution, because it is not necessary to say: "We noticed that we were wrong, and we had to change"; it is enough to state: "We have just reached a better understanding of what we should do today, which completes the meaning of what we were doing before." This is why some theologians have commented with some humor that when a pope wants to say something opposed to the perspective of the previous pope, it is usually enough to introduce the statement using the words, "as my memorable predecessor said," and no one will notice the shift (Masiá Clavel, 2007).

Therefore, the Catholic Church has had different theologies and different self-understandings throughout the centuries. We can use, then, the word *theologoumenon* for each of the theological interpretations which have appeared over time—some of them more influential than others in the development of theology as a discipline of knowledge. The most coincident perspectives through time can be understood as the Tradition, and the most influential have been eventually integrated into different levels of the Magisterium of the Church. The Magisterium could be more or less the official teachings

of the bishops and the pope, and its maximum level is the Ecumenical Council led by the pope. In Catholic theology, the Bible, the Tradition, and the Magisterium are the three sources of the Revelation of God (not only the Bible by itself).

If pastoral work means the action of the church, that is, the evangelization, it is as old as the church. But the concept is not that old. Pastoral theology was introduced in theological curriculum in 1774, as part of the changes moved forward by empress Maria Theresa of Austria. It was initially centered around the priest as the unique shepherd (pastor) of the community. This was consistent with an androcentric-clerical perspective, because pastoral theology has always been closely related to the ecclesiology (the theological understanding about the church). The discipline evolved as part of Catholic theology until it grew into its current shape under the influence of the Second Vatican Council and the post-conciliar theological trends.

There is neither one ecclesiology, nor one pastoral theology, but several different perspectives, emphases, and strategies. Thus, the concept of models, borrowed from the social sciences, is useful for analyzing and comparing. The concept gained popularity at the end of the 20th century among some theologians as a tool to compare different theological paradigms and their pastoral implications (L. Boff, 1982; Dulles, 1975). The use of this tool provoked controversy in some hierarchical Catholic environments, because it was considered a reductionist approach to ecclesiology, which ignored the spiritual—pneumatic—dimension of the church. Nevertheless, the concept seems useful from a sociological perspective, since it shows validity and flexibility to approach different styles of pastoral work in order to identify and compare their key elements. It seems that the controversy has not been that sensitive in the context of pastoral theology—compared to ecclesiology—since we find commonly used handbooks referring to “models of the pastoral work” (Floristán, 2002). We should add that current

perspectives generally consider pastoral work as the main field of relationship between the church and the social world.

During the discipline's evolution, there has been a major contribution to the understanding of the different dimensions of pastoral activity in the handbooks from the end of the 19th and the beginning of the 20th centuries. The books have been influential, because they have served as textbooks for training priests and other pastoral agents. Such works understand the mission of Christ, the Good Shepherd, as an integration of the three messianic dimensions—the threefold office or *tria munera*—of prophet, priest, and king. The dimensions of the priestly, prophetic, and kingly ministry of Christ correspond to pastoral tasks. The first two have been clearly related to the prophetic pastoral (related to teachings and doctrine) and the liturgical pastoral (related to sanctification and cult). The third dimension has had diverse meanings, including the organization, the service of authority (government), and the—most common currently—social pastoral. This scholastic framework can be compared to some Protestant perspectives, where pastoral theology is usually called practical theology. A major difference in some Protestant literature is the understanding of pastoral care: it is mostly understood in terms of counseling or other interactions to cope with personal problems and difficulties, such as sickness, depression, crisis, old age, and so forth. On the Catholic side, the three dimensions—prophet, priest, and king—are also related to the main dimensions of the religious practices of faith, liturgy, and morality. Those can be the main aspects to evaluate a religious group: Is it loyal to the Catholic faith (orthodoxy)? Does it celebrate the liturgy correctly (ortholatry)? And does it behave according to the moral principles (orthopraxis or orthopraxy)?

The multidimensional pastoral work has been officially understood as including the social work of the church. Therefore, the reports of the bishops to the pope, and the

data gathered by Rome and published in the Pontifical Yearbook include information on hospitals, schools or nursing homes, etc. Those sources include the data as indicators of pastoral work, including religious and social services. The distinction comes from the sociological perspective although the church's perspective considers both as pastoral services. From a secular sociologic perspective, we could say that prophetic and liturgical pastoral are considered religious services, and social pastoral is understood as the social services provided by the religious organization; but, we should be aware of the organization's understanding of its own activities.

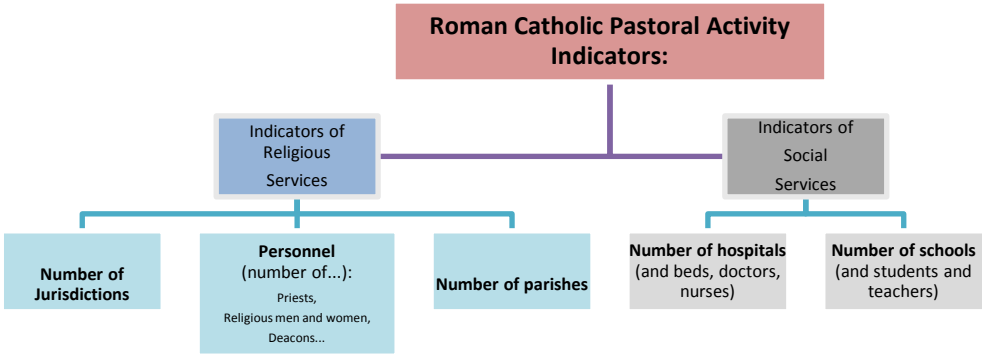

Figure 2: Indicators of Pastoral Activity

Although the Catholic Church has a self-understanding as a society including all the Christian faithful, the organizational decisions lie in those governing the church (the hierarchy). Therefore, from a sociological perspective, the Catholic Church can be understood as a hierarchical organization led by the supreme authority of the pope at the world level and by the "local" authority of an ordinary—usually a bishop—at the level of each Ecclesiastical Circumscription (EC). The ECs are basic administrative units. Nonetheless, from the perspective of the church, they are not only organizational units, but local churches. Each circumscription is a local church entrusted by the pope to a bishop (C.I.C., c. 368), although in some cases the ordinary of the EC could be a priest

not consecrated as bishop. The relevance of these local churches could be understood from statements of some theologoumena of early Christian traditions referring to the pope as "first among equals"—*primus inter pares*—in relation to the other bishops. Even if current Catholic theology, particularly from the First Vatican Council, acknowledges an absolute primacy of the pope, the bishops are still highly independent.

ECs are usually territorial because they encompass a geographical area.[2] The most common kind is the diocese, but there are other kinds as well. Some circumscriptions such as prelatures or apostolic vicariates are considered dioceses in the development stage. Some dioceses have special prestige and dignity and are elevated to archdioceses, which can be the head of an ecclesiastical province. In such cases the archbishop is the first among equals; he does not have direct authority over other bishops in the province. In other words, no one can decide for a bishop in his circumscription. Thus, all other organizational bodies—including provinces or national conferences of bishops—are not properly speaking hierarchical entities (C.I.C., c. 331, 368-369).

The religious policy basically depends on the bishop, who decides if, when, and where a parish should be created, and who is to be appointed as the pastor. He even has the final decision about who can be ordained as a priest in the EC under his jurisdiction. The preferences and interests of each bishop could be different from those of the bishops in the neighboring ECs. This makes it possible to identify different priorities in each diocese. Even if the bishops of a whole country sign an agreement, the final decision of how to implement it in an EC lies with each bishop. EC is both a policy-decision level and a service-provision level.

[2] PREC has made the methodological decision to ignore the non-territorial circumscriptions (as the military ordinariates) and distribute their pastoral work in the corresponding territorial circumscriptions.

ECs usually are the proper level of analysis in order to study the Catholic Church, focusing on its official and structural dimensions, and they are the official level for preserving historical Catholic data such as those gathered by the Central Statistics Office of the Church and published reports and yearbooks (AP, 2010). This is also the level of the reports of the Catholic Church periodically presented to the pope (*relationes diocesium*). Therefore, ECs are the proper units of analysis for pastoral care.

Whereas ECs are local churches, parishes are the basic unit of provision of pastoral care according to the Canon Law (C.I.C., c. 515-518) and the common Catholic practice. Parishes tend to show the characteristics of the bishop's preferences more than in terms of their location and extension, because the priests or even the pastors of the parishes are limited by the direct authority of their ordinary. The parish, even being unstable in terms of borders, usually encompasses an area; and the population residing inside the parish boundaries are supposed to be served by a pastoral team (pastoral agents) led by a "Pastor." There can be other kinds of churches and chapels, but the parish is the basic center for administration of sacraments, and only parishes are supposed to keep the proper books to record baptisms and marriages. Therefore, if any population is considered a beneficiary of pastoral services, most of these services should be provided through a parish. If there is a higher rate of parishes, we can assume that there is a better offer of religious services; thus, the corresponding population is prioritized. Since pastoral care is directly offered by parishes, they are also an appropriate unit for this analysis.

In any case, most policies and strategies of pastoral work are decided by the hierarchy of the church. In terms of the two basic structures for providing pastoral services, both are created by the decision of the highest corresponding hierarchical level of the church: the erection of circumscriptions (ECs) depends on the pope, who is the

maximum authority of the church, and the erection of parishes depends on the bishop, who is the maximum authority in each circumscription.

The hierarchy is also involved in the decisions about the particular strategies or policies for social pastoral activities. This dimension of pastoral work is what we call, from a sociological perspective, social work or social help. It can be understood as any assistance to individuals and groups—particularly those in urgent need—to overcome problems and favor their potential (Sheafor, Morales, & Scott, 2010), including the services offered with such a goal. I will use here a very broad perspective, leaving a deeper discussion about the definition to specialized literature (Hare, 2004). This broad perspective includes services addressed to needs that could be considered material, and services addressed to other kinds of needs—including those that are the object of religious services. From the Catholic theological perspective, the different kinds of services are part of the pastoral work, so we can say that pastoral work—the main goal of the Catholic Church—could be understood as some kind of social work, although different theological perspectives will emphasize different kinds of services.

The former concepts help us understand pastoral indicators from the perspective of the religious organization, but also in relation to their social implications. We can measure the number of ECs and parishes as well as pastoral agents involved in different tasks and of other works such as schools or hospitals. The available indicators can be used to evaluate pastoral priorities (from the church's perspective) or religious and social services offered by a religious organization. When we evaluate the distribution of pastoral services, we are evaluating the trends in the decisions of the hierarchy as they can be empirically measured. Due to the complexity of pastoral work, there will be a need for other complementary measurements, and also qualitative approaches, to better understand the priorities. But, even if the measures we have listed do not encompass the

multiple dimensions of pastoral work, they are a legitimate way of measuring some aspects. Furthermore, they are also useful for the church as an organization to evaluate its own pastoral priorities. Since the models of pastoral work identify and classify roles and priorities of different actors involved in the pastoral action, when we compare the geographical concentration of services we also find embryonic elements to identify different models of pastoral activity. The broader research agenda for the future will include other elements corresponding to different models of pastoral work, such as the social services (social pastoral indicators), the creation of circumscriptions and parishes, and the existence of lay ministries, among others.

However, the understanding of the hierarchical organization of the church and its pastoral dimension in relation to social help to the poor does not provide a complete context for the preferential option for the poor. It also needs some historical notes, which will be provided in the following sections.

3.2 THE POOR IN LATIN AMERICAN PASTORAL PRACTICE AND THEOLOGY

Colonial Period

Pastoral care seems to have always included the principle of Christian solidarity (Schneider-Harpprecht, 1997), although the historic pastoral practices have had several different ways of implementing such a principle. In Latin America, the history of social help after the arrival of the Spaniards and the Portuguese begins with the history of Christian charity. The Catholic Church has been involved in the strategies to improve the conditions of the poor from the beginning of the colonial period, and health and education have probably been the major fields of such interventions (Fasolino, 1956; Klaiber, 2009; Lohmann Villena, 1958; Muriel, 1990, 1991; Newland, 1991; Pimenta, 2010). The Spaniards created hospitals for indigenous peoples from the first decades. It

was a “pious work” inspired in Christian charity, supported both by private donations and by the ecclesiastical tithe. Hospitals were administered by the secular clergy, the religious orders, or lay confraternities (C. Torres & del Rio, 2001, p. 71). Besides hospitals, the laws provided the foundation of nursing homes for orphans and elders. The goal was supporting a better life quality, although these works had limited sensitivity toward indigenous culture.

The first schools were founded after the hospitals, and they were supported by the religious orders, the ecclesiastical tithe, and the civil administration (Araújo, 1905; Leyes de Indias, 1680). Missionaries were the first teachers—in the European style—who trained the indigenous peoples in reading, writing, basic math, and handcrafts. Every indigenous town was supposed to have a school, but this, of course, was far from reality. Nonetheless, there were several elementary schools and some secondary schools for the indigenous nobility. Besides primary and secondary schools—which are called *colegios*, in Spanish, or *colégios*, in Portuguese—the first universities of the Americas were founded by the Spanish Crown in Lima and Mexico City in 1551 (Leyes de Indias, 1680).

In Latin America, the defense of the indigenous peoples during the colonial period was not mainly motivated by theology, but from the perspective of the law. It was a legal concern about the right of conquest, and even the existence of the souls of the indigenous people was discussed in legal terms.

Charity, as a dimension of Catholicism, was emphasized in the Counter-Reformation as part of the relevance of works to complete the faith, versus the perceived Protestant preaching of justification as received by faith only (*sola fides*). For example, the Catecismo de Ripalda lists the seven works of material mercy, including visiting the sick, feeding the hungry, and dressing the naked (Ripalda, 1616). This was the most important printed catechism in Mexico until the middle of the 20th century and was

written by the Jesuit Jerónimo de Ripalda in 1616. It was translated into Náhualtl in 1758 (H. de León-Portilla, 1988) and also into other indigenous languages such as Maya, Otomí, Purépecha, Zapoteco, and Mixteco. However, the works of mercy were not conceived here as a demand of justice, but as an answer to urgent needs. They would ideally inspire a social behavior of care for the poor, but it would result from the good will of the individuals, not as a result of a moral obligation.

Independent Countries

Colonial church and civil administrations worked together before the independence of Latin American countries to provide the social services. Social help was always insufficient for the poorest population—the indigenous peoples or the African slaves—and this did not change after the independence. In some cases, the government of the new independent nation continued to favor the development of the Catholic Church; in other cases, state and church publically criticized each other, but in both scenarios, even when some kind of social help was provided by either of them, both were mainly interested in their own power.

The theological environment of Latin American Catholicism did not have much variation from the colonial period to the 19th century. The region was deprived of the theological advance happening in other missionary environments because it was not considered a—properly speaking—mission territory. The Spanish church depended on the Spanish crown, mostly through the Royal Council of Indies (Consejo Supremo y Real de las Indias). After gaining political independence from Spain, the Latin American church fell under the jurisdiction of the Consistorial Congregation, but it never was under the jurisdiction of the Congregation for the Evangelization of the Peoples (Propaganda Fide). We can say that the main Catholic concern after the independence was the

reestablishment of the hierarchy, since several bishops of the former Spanish colonies went back to Spain and there was no formal relationship with the Holy See to restructure the ECs or appoint bishops. By the middle of the 19th century, the Vatican officially recognized the independent countries and it was possible to consolidate the hierarchy of the church.

Local and provincial Latin American councils mainly prioritized the formal organization of the church, as shown by the constant references to the Canonical Law in the documents from the councils. In the late 19th century, the First Vatican Council (1868-1870) responded to the criticism of modernity and the policies of liberal states by declaring the infallibility of the pope (Pastor Aeternus). This consolidated the papal authority over the church and stressed even more the hierarchical order. Nevertheless, the I Plenary Council of Latin America, held in Rome in 1899, shows some echoes of the social concerns of Leo XIII in his encyclical letter of 1891 on the social situation (Rerum Novarum). The Council of Latin America has some statements on charitable works. The hospitals and nursing homes are considered the most important, in order to assist the poor (CPAL, 1906 XI.V.790), and the Council demands their maintenance and reconstruction when necessary. It also prioritizes, in any difficulty, the maintenance of liturgy and charity work. The property and resources of the church are understood as being addressed to the liturgy, the help of the poor, and the sustainment of the clergy (CPAL, 1906 XI.II.829). The order of these three elements is important, since in ecclesiastical documents it always means priority unless otherwise specified. The council urges the laity to provide economic support to the church, but also forbids any charge for religious services to those “truly poor” (*verdaderamente pobres*); it emphasizes the relevance of avoiding any appearance of greed and forbids the charge for confession under any circumstance (CPAL, 1906 XII.II.831). Even if not a council marked by social issues, the

statements point to a pastoral model, which acknowledges certain relevance of helping the poor.

Before the Second Vatican Council

Because of the study of the Bible and the influence of existentialist philosophy, Catholic theology slowly shifted during the 20th century. The official acceptance of the symbolic interpretation of the Bible in 1943 (Divino Afflante Spiritu) made it possible to clarify the implications of interpretations of the Catholic faith that have already been discussed.

In the second half of the 20th century, the understanding of social work changed in Latin America. The evolution of social sciences in the region awakened a critical social consciousness. In the context of the promise of economic growth and development, Latin American scholars, led by Raúl Prebisch, described the whole world as divided into countries in the periphery—producing primary goods—and countries in the center—producing secondary goods—but both related in a unique system (Prebisch, 1950, 1986). His paper has been considered, in the words of Albert Hirschman, as the "Latin American Manifesto" (Silva Barros, 2007), and actually focuses the region as a coherent unit with common situations. The idea developed into the dependency theory and was strongly influential in the Latin American scholastic environment. To counter dependency there was a need for independence, freedom, and liberation, and this found a fertile field in Catholic popular environments because of three crucial situations related to the identity and pastoral work of the Catholic Church:

- The creation of the Latin American Council of Bishops (CELAM)
- The creation of Caritas
- The origin of the Base Ecclesial Communities

The I Conference of the Latin American Bishops (Rio de Janeiro, 1955) had the influence of French, German, and Roman theologies, and even had Protestants as invited observers to the meeting. There was an emphasis on the Latin American identity, and the Latin American Council of Bishops (CELAM) was created to address the particular challenges of the region (CELAM, 1955). The bishops showed a particular concern for the situation of the poor: Caritas—the office of social help—was created in most Latin American Dioceses after the Conference. This intended to answer the situation of poverty by providing social help all over the subcontinent.

In a more local context, the Base Ecclesial Communities (in Portuguese, Comunidades Eclesiais de Base, CEBs) started in Brazil, in 1957. They were initially designed as a strategy to answer the Pentecostal groups present in the popular environment of Barra do Pirai, a community close to Rio de Janeiro. It was actually a group of Catholics who asked Bishop Agnelo Rossi for his authorization to have a meeting in the church without a priest in charge of the celebration: they could not have a mass, but were able to read the Bible and pray together. After the approval of Monsignor Rossi, the idea spread into other Brazilian parishes, which soon became a network of small communities (CNBB, 1982; Marins, 2007). The groups adopted the method created in France by the Jeunesse Ouvriere Catholique (JOC, Young Catholic Worker movement) in the 1930s, consisting in three steps of see-judge-act in order to avoid the separation between faith and life (Biord Castillo, 2004). A little later, the method was paired with Paulo Freire's pedagogical perspectives of education as a practice of freedom (1967, 1968). All this experience was positively evaluated by the Brazilian Conference of Bishops, which recommended in 1962 the identification of natural communities and the pastoral work originating from their reality (CNBB, 1982).

Changes after the Second Vatican Council

From 1962 to 1965, the Catholic Church experienced one of its most important organizational changes in the Second Ecumenical Vatican Council. An ecumenical council is a general meeting of bishops representing the church all over the world and constitutes the supreme authority of the church, even over the pope by himself.

The council clarified important issues about the church and its tasks. It was considered a “pastoral” council because it was not focused on dogmatic definitions, but on the need of answering to the contemporary world and its challenges. The council faced both the need of changes inside the church and the need of reconsidering the theological meaning of the world where the church existed. It pointed to the relevance of identifying historical challenges, called “signs of the times” (Matthew 16:3; Luke 12:56), and this was to be understood in Latin America by increasing the attention to the situation of poverty. The council explained that the social situation, particularly of the poor, could not be ignored by the church. Quite conversely, it should be a main concern of the church: “The joys and the hopes, the griefs and the anxieties of the people of this age, especially those who are poor or in any way afflicted, these are the joys and hopes, the griefs and anxieties of the followers of Christ" (Gaudium et Spes, n. 1).

A little after the council, in 1967, the Pope Paul VI also expressed his concern about the development of different nations:

> The injustice of certain situations cries out for God's attention. Lacking the bare necessities of life, whole nations are under the thumb of others; they cannot act on their own initiative; they cannot exercise personal responsibility; they cannot work toward a higher degree of cultural refinement or a greater participation in social and public life. They are sorely tempted to redress these insults to their human nature by violent means (Populorum Progressio, n. 30).

The pope even remembered in his encyclical letter the traditional doctrine that a revolutionary uprising is not immoral “where there is manifest, longstanding tyranny

which would do great damage to fundamental personal rights and dangerous harm to the common good" (Populorum Progressio, n. 31).

The Latin American Catholic Church, encouraged by the council and the pope, welcomed social engagement. The II General Conference of the Latin American Bishops met in Medellín, Colombia, in 1968 and adopted as a thematic slogan, "The church in the present-day transformation of Latin America in the light of the council" (CELAM, 1968). The "present-day transformation" of the title was usually understood as a reference to the socio-economical context of the region. Although the option for the poor is not part of the wording of the document, it can be a good way of synthesizing its contents. It was actually after Medellín that some theological environments insisted on such an option.

The CEBs were also encouraged by the Conference in Medellín to adopt a pastoral model of empowering the poor (CELAM, 1968). The Latin American cultural context, including dependency theory and the pedagogy of Freire, also favored the creation of base groups in other non-religious contexts interested in the struggle for the liberation of the subcontinent. Some groups looked for violent methods, but most commonly they worked in what was called popular education, and, as a subfield of it, popular education in health (also called popular health). The first experiences of pastoral strategies to work hand in hand with the poor in Latin America were linked to the origin of popular education.

Popular work is, in general terms, equivalent to popular education, because the main goal is to foster a renewed perspective on the whole world, a new consciousness—*concientización*, in Spanish, or *concientizaçao*, in Portuguese—which is the starting point for social change (C. A. Torres, 2004). Traditional perspectives of education for the poor were centered in teaching contents and meanings, that is, transmitting something that poor and ignorant beneficiaries of social work did not have before. Popular education is

understood as the dialectic interaction of learning together or building contents and meanings together. Each teacher is a teacher-student and each student is a student-teacher. Note that this was also assumed as part of the process of learning together how to read the Bible among the poor, as opposed to former perspectives of teaching the poor how to read the Bible. Thus, education—including religious education—becomes a political intervention to empower the poor (El Achkar, 2009). It is significant that when popular health integrates traditional healing practices, it emphasizes the appreciation for popular culture and heritage. Therefore, we find that active participation of the poor is a main element in the literature about popular work (C. Boff, 1986), popular education (Ibáñez, 1988; Mejía J. & Awad, 2003; Rodríguez Brandao, 1989; Sime Poma, 1991), and popular health (Mueses De Molina, 1993; Ramirez-Valles, 1998). This is coincident with the research in the U.S. about the participation of the population in neighborhood organizations, showing how this is linked to the organization's efficacy (M. Ohmer & Beck, 2006; M. L. Ohmer, 2004).

This way of understanding popular work fits well in a broader context of the increasing relevance of civil society in the fight against poverty. Former experience shows the limitation of economic aid offered to governments in developing countries, usually characterized by higher corruption levels. Non-governmental organizations (NGOs) or civil society organizations (CSOs) have become more relevant in the policies and programs to overcome poverty. NGO was a term used by the UNDP until 1993 to include those instances of not being part of the state nor of the market. Today, a better concept is CSO, since the term:

> encompasses a wider variety of organizations engaged in development work. CSOs comprise the full range of formal and informal organizations within civil society: NGOs, community based organizations (CBOs), indigenous peoples' organizations (IPOs), academia, journalist associations, faith-based organizations

> [FBOs], trade unions, and trade associations, for example. Civil society constitutes a third sector, existing alongside and interacting with the state and market (UNDP, 2006).

UNDP defines civil society organizations as "non-state actors whose aims are neither to generate profits nor to seek governing power" but to "unite people to advance shared goals and interests" (UNDP, 2001). From this perspective we can state that organizations engaged in popular education are CSOs engaged in social work, which are gaining relevance in the current context as part of civil society. In this larger context, we find the faith-based organizations (FBOs)—among other CSOs—gaining visibility, not for being religious, but for being part of civil society and interested in social projects. Actually, FBOs are sometimes recognized in this context for being located in the poorest areas (Kearns, 2006). From Latin American perspectives, a new style of social work was born, which could be called popular work (C. Boff, 1986).

In the Catholic intellectual environment, some theologians were influenced by all these changes, particularly by the energy and liveliness of the CEBs. They used in their theological work both the method and the faith intuitions—*sensus fidei*, common sense of the faithful—to generate a new theological interpretation—theologoumenon—called liberation theology (L. Boff, 1977). In fact, some Latin American theological and pastoral perspectives are mainly interested in social projects—although coming from a religious motivation. In these perspectives, the construction of the Kingdom of God is closer to participate in social, political, or revolutionary projects than to convince people of the value of Catholic dogmatic teachings.

Notice that Liberation Theology appears, in the first place, as a result of the church dynamics lived in pastoral models of popular work and particularly in CEBs. The theologoumenon appeared from the pastoral strategy, but its theological contents—and the later versions of it—facilitated the expansion of the CEBs in the whole of Latin

America. Also, notice the dialectic between the (ecclesial) practice and the cultural production of multiple disciplines such as economics, social sciences, pedagogy, and theology, among others. Theologians declared that liberation theology was not just a sub-area of the discipline, but a new manner of doing theology with its own method (C. Boff, 1998). In similar fashion, popular work does not appear as a subfield of social work, but as a particular way of doing social work.

Beyond religious environments, social scientists saw with renewed interest the central concern of religious institutions for social problems instead of individual and spiritual issues, or—better said—the reading of individual and spiritual issues in social terms and inspiring socially engaged practices. About forty years ago, Sanders considered that the Catholic Church was the Latin American institution changing most rapidly, and stated that this had "important implications not only for defining new relationships between Christianity and the values of society, but also for the role that the church will play in the region's development" (Sanders, 1970, p. 285). Nevertheless, the change has been usually understood as rooted in Liberation Theology and some of its manifestations, but most scholars have ignored the central role of pastoral practices of popular work.

The "new" social engagement was perceived in diverse ways by Catholics—directly or not directly involved in popular work. There was fear in some sectors of the church; there were attempts to delude the meaning of poverty by ignoring or excluding its sociological dimensions. There were people afraid of an understanding of the option for the poor that could marginalize the rich, and they insisted on an adjective to clarify the option for the poor. Such an option would be preferential, but not exclusive. The internal tension is reflected in the conclusions of the III General Conference of the Latin American Bishops in Puebla, Mexico, in 1979. The text shows that there are more religious brothers and sisters located in the areas of poverty, but even though this option

gives preference for and promotes nearness to the poor, it does not encourage the exclusion of anyone (CELAM, 1979 n. 733).

The fear of social engagement was favored in the new ecclesial context after the death of Paul VI (August 1978). After the month-long pontificate of John Paul I, a Polish bishop was elected pope, and, according to some ecclesiastical analysts, he appeared to be more concerned about the extreme of Marxism than about the extreme of poverty (Libânio, 1983). Liberation Theology had been sometimes close to Marxist perspectives when analyzing society; and it was considered that:

> the thought of Marx is such a global vision of reality that all data received from observation and analysis are brought together in a philosophical and ideological structure … Thus no separation of the parts of this epistemologically unique complex is possible (Libertatis Nuntius, VII.6).

Notice that the criticism and censoring of some particular aspects of the theologoumenon were actually addressing a conceptual and hermeneutical problem, not the legitimacy of the pastoral model of preferential option for the poor. Thus, the option ended up integrated into later theologoumena. From this point, it excluded Marxist language and radical political commitment, but it continued to give evidence of the church's interest in the improvement of the life conditions of the poor.

Liberation Theology is not currently considered the main theologoumenon of Latin America, particularly considering the leading teachings of most seminaries and other theological and pastoral training institutions. Nevertheless, the statement of the option for the poor has remained, and it is not limited to theological production. It is currently present in the latest official documents of different bodies of the church (Cáritas Mexicana, CEPS, & Lindavista, 2010).

Most research approaches to the option for the poor have focused on radicalized or particularly politicized sectors of the church. Such studies may focus on the effect of

particular theological influences. Nevertheless, the evaluation of the option for the poor, in pastoral terms, is the evaluation of a declared official policy of the church, and, as such, can be useful for external and internal evaluations of such a statement. The evaluation is most pertinent now because the change, in terms of giving some priority to the poor in the theological and official discourse, is relatively consolidated after forty years—but there has not been any empirical test of such option at a broad level. In this study I approach the most institutional dimension, assuming that the presence of pastoral services in some areas, and not in other places, has been an effect of trends in decisions of religious authorities.

3.3 CURRENT ISSUES ON THE OPTION FOR THE POOR

The important shift after the Second Vatican Council and the Conference of Medellín positioned the poor as the object of a preferential option both in theological speech and in the official teachings of Latin American Catholicism. This has remained as a pastoral ideal, no matter if liberation theologoumena gain or lose popularity. Among the topics related to this option and deserving particular attention is the relevance of the mere location of the work and the understanding of the option for the poor as a strategy of religious competition.

Being with the Poor

Social help has traditionally been understood as bridging resources to the poor, but the organizations providing such help are not necessarily located among the poor. In fact, most studies on social work emphasize the study of the characteristics of marginalized populations and/or the study of the effects of particular interventions and programs (Hall, 2008; Ramirez-Valles, 1998). Few studies have focused on the presence of the organization within the spatial contexts of poverty, which is the field where this

research belongs.

However, the preferential option for the poor does not always mean popular work, because being with the poor is not enough to signify work. An organization—the church in this case—can be located and offering services in areas characterized by higher rates of poverty, but mainly channeling resources coming from external sources or not even directly engaged in social projects. We actually find critiques to the religious presence among the poor from the beginning of the 20th century, stating that missions in poor areas had a symbolic dimension, but were useless and even negative in terms of overcoming social problems (Jameson, 1931). In this case, the author points to the disadvantages of transferring, to the poor, resources which come from outside their own environment. In popular work there is a new attitude towards the poor, looking towards understanding them as subjects of their own history. This shift is not easy—or even possible—without being in the same geographical coordinates of poverty.

Thus, the option in terms of location is not enough, but it is a necessary condition and actually was in some ways the unintended beginning of the new experience. Being with the poor favors deeper changes. For instance, the CEBs started as a strategy of religious competition, concerned in maintaining members and the influence of the Catholic Church. However, when CEBs gained identity, they shifted their goal and refocused on the interests of the poor. They have been recognized for their ecumenism and collaboration with non-Catholic, or even atheist, groups, if such groups shared their concerns. Other agents of civil society, usually distrustful of Catholic groups or religious-based work, actually refer to CEBs as a valuable initiative in popular work.

Even without the particular perspective of popular work, being with the poor seems to have some effects. When poverty concentrates in a neighborhood, it fosters adverse conditions to social capital, in terms of networks and trust. This situation can be

identified as the neighborhood effects, or the community dimension of poverty (CONEVAL, 2009; K. L. Osterling, 2007; Kathy Lemon Osterling, 2007). But the presence of organizations providing social work favors the increase or development of social capital in poor neighborhoods (Fellin, 1998). Social capital is currently an important concept to evaluate the advantages and achievements of social work among the poor, as well as the advantages and achievements of popular education and CSOs in general. Latin American literature emphasizes how a community gains resources when it strengthens its interaction and cohesion (Fabre Platas, 2009). The mere increase in social cohesion is a way of overcoming poverty, since lack of cohesion is considered a dimension of poverty (CONEVAL, 2009). The presence of organizations in areas of poverty also expands social capital by offering external links to the community (Small, Jacobs, & Massengill, 2008). Notice that this does not require the style of popular education, but comes from the mere fact of being an organization externally linked but located among the poor, which presents advantages and opportunities both for the community and for the organization itself. The organization can channel resources, even in urgent cases, because of its location. An example of this was the European humanitarian aid administered by the Catholic organization Caritas through the parishes in Cuba during the “special period” (when some governmental channels were not trusted by European aid offices). In a similar fashion, the presence of more than one organization will also favor the collaboration among them (Mulroy, 1997).

The location also makes possible the development of particular programs to support the improvement of life conditions (Schneider-Harpprecht, 1997). Sharing the experiences of the poor and gaining their confidence is critical when the organization wants the community involved or supporting anything (Ferrer, 2008). Proximity between poor communities and organizations offering any kind of services matters because,

"geography structures opportunity sets for low-income households" (Allard, Tolman, & Rosen, 2003). When someone has closer resources, it increases the chances of taking advantage of them. Since social work organizations change the opportunity structures, communities without their presence can be considered in disadvantage (Hetling & Zhang, 2010; Murphy & Wallace, 2010).

There is still need of more research to show the relevance, meanings and explanations of being located among the poor. Popular work and social work among the poor have raised questions and interest because they are directly looking to meet social goals. FBOs share this situation. CEBs are theologically conceived as a way of being church (L. Boff, 1977), and not properly as FBOs, but they represent an important landmark in the history of popular education in Latin America, and do not directly depend on hierarchy for their dynamics. Nevertheless, there is still need of focusing on the presence of the church, as an organization, among the poor.

The meaning of the location of the parish has been evaluated depending on the way—more than the fact—of being there. In many parishes the only relationship of the organization with the poor population is through the charitable work, which corresponds to the social pastoral and can be, more or less, formally organized. That usually remains limited to donations and good feelings, and it does not reach more than a few families (Claudia Neves da Silva, 2006). In other cases, the location among the poor could be an instrument to link the community to CEBs and/or to social programs of FBOs or other CSOs. That happened in the 1970s, fostered by the Brazilian parishes located in poor areas (Cláudia Neves da Silva & Lanza, 2010). It has been admitted that:

> Catholic priests and sisters working with the poor in Latin America enjoy a unique situation. They are from outside the culture of the poor—by nationality, birth, and upbringing, or at least through incorporation into the clergy or a religious order and yet they can live alongside the poor and share their lives in a

> way that politicians or professional people cannot (Berryman, 1994; Holden & Jacobson, 2009).

It seems that the very presence of pastoral agents among the poor has a symbolic dimension, and it favors a more sensitive perception of the needs of the poor (Orr, 1995). In an idealistic perspective, the Catholic Church would be a "neighborhood church" and Catholics would build "their community … around the Church" (Kantowich, 1980). This presence would be very meaningful because of a deep interaction between the religious organization and the community.

Coming from a context of social concern, the preferential option for the poor cannot be reduced to the geographical concentration of pastoral services, but such a concentration has also been considered by the church as evidence of such an option. The priorities of pastoral work synthesize social, religious, and ethical dimensions. Helping the poor has been a constant ethical teaching of several religious traditions, and particularly from a Christian perspective, but only in recent times have the poor become a theological locus or a pastoral locus.

Religious Competition

There have been different explanations about the shift of some sectors of the Latin American Catholic Church to socially progressive Catholicism—including the option for the poor, liberation theology, and other similar changes. Social scientists have identified causes from both inside and outside of the religious organization, including modernization, radicalization, or response to the surrounding context. More recent literature about the religious changes in Latin America (Bastian 1997) emphasize the relevance of the presence of non-Catholic Christian groups, and particularly Pentecostals, as the most important phenomenon to be analyzed instead of social engagement. The current trend in sociology of religion favoring rational choice perspectives adds in the

same direction and understands the Catholic social interest as a result of religious competition—focusing on the whole of Latin America (A. Gill, 1998; A. J. Gill, 1994) or limiting the scope to Mexico (Trejo, 2009). In this perspective, Protestant competition would be the main drive in the interest of Catholic bishops and priests in order to favor the poor or social movements. In the case of Mexico, this has been tested regarding social movements in indigenous areas, presenting also that there is more mobilization in places with higher competition. The hypothesis was initially published by A. J. Gill (1998; 1994), and it was received with enthusiasm by some scholars (Sherkat, 1999; Trejo, 2000), but other researchers indicated some important limitations (Hégy, 1998; Mackin, 2003). The main critique in methodological terms points to the inappropriate level of analysis. As I explained, the study of a Catholic pastoral policy should include the ECs as units of analysis, or at least include some clustering for such a level.

It can be enlightening to add some comments about Trejo's research on religious competition (2009) because it studies the Mexican Catholic Church and is concerned about a problem related to the option for the poor. It is interesting that Trejo himself commented on Gill's book sometime before (A. Gill, 1998) acknowledging a main limitation when data are not aggregated by ECs (Trejo, 2000). However, the study of Trejo (2009) has the same inadequacy because he aggregates the data by municipalities. This is because, in order to achieve the required level of aggregation, it is necessary to process the data similarly to the strategy used in the research at hand (which has not been done before). Another limitation in the study of Trejo is the assumption that people can change their stance on social issues because of religious competition, but that they cannot change their engagement in religious competition because of social situations. This assumption is challenged by the fact that CEBs originally motivated by competition became an environment of dialogue and collaboration with people having different faiths

as well as with agnostics and atheists who shared the interest for social change. Trejo's paper also ignores the common references to the ecumenical position of Samuel Ruiz, the existence of Sergio Méndez Arceo—the most radical Mexican bishop, who is also characterized by his ecumenical work (Mackin, 2003), and the presence of other bishops concerned with social issues both in non-indigenous (Manuel Talamás) and in indigenous (Bartolomé Carrasco) contexts in Mexico. Nevertheless, regardless of the limitations in Trejo's and Gill's research, it would be wise to control the influence of competition when studying the option for the poor.

We have already shown that at the origin of the CEBs there was a concern about competition, but the pastoral strategy was redefined and expanded across the subcontinent on different terms (Marins, 2009). Therefore, when following organizational strategies, we should consider that they can be adjusted—particularly when there are also changes in the organization. We can observe that both Protestant and Catholic environments that promote liberation theology, popular work, and option for the poor, currently show the priority of social concerns (ADITAL, 2012; Amai-vos, 2012; CEE, 2012; DEI, 2012; Observatorio Eclesial, 2012). Of course, the criticism of Catholic authoritarianism appears, but this criticism is voiced more often from Catholics themselves than from Protestants. In contrast, some traditionalist groups, such as the followers of Marcel Lefevre (Moore, 2004), condemn both liberation theology and ecumenism as part of the same ideology for both being Marxist. We can also observe that the latest production of socially engaged theology is characterized by even stronger ecumenical references (Vigil, Tomita, Barros, & EATWT, 2003, 2006a, 2006b, 2010, 2004). I should add that for some scholars it seems more plausible to consider the conversion to Pentecostal churches a consequence of the option for the poor (Damacena Martins & Pedrosa de Pádua, 2002; Mackin, 2003).

Now that some elements related to the option for the poor have been discussed, a summary view of the particular characteristics of the study on the Mexican Catholic Church will complete this basic framework.

3.4 CHARACTERISTICS OF THE CATHOLIC CHURCH IN MEXICO

According to one of the most prominent scholars of religion in Mexico, México is no longer a Catholic country, if it has ever been (Blancarte, 2010). He states that Mexico is on its way to increasing religious diversity, and even if the image of the Virgin of Guadalupe is still an important symbol, it faces increasing competition from other popular symbols.

Nevertheless, even if we admit the most conservative figure of a 73.9% Catholic population in the country (Hagopian, 2009), that would mean that a majority of almost three out of four people are adherents. Furthermore, the results of the last census point to 83.9% (INEGI, 2011b). If Catholics do not support the official doctrine of the church in some aspects (Oakley & Rodriguez, 2005), it does not mean they are not Catholics anymore, but that they are reconstructing their Catholic identity, and the influence of the church remains an important factor. In terms of symbolic reference, the youth survey of 2005 (IMJ/SEP, 2006) shows that a proportion of young Mexican Protestants still admit their belief in the Virgin of Guadalupe.

I already showed that contemporary research has been underlining the relevance of non-governmental organizations (NGOs) and religious based organizations (RBOs) as part of civil society. Since they favor contemporary changes—and even seem effective in combating poverty—civil society is gaining importance as a third force, besides the state and the market, in configuring social life. But the Catholic Church was there before the configuration of modern states and capitalist markets. The modern Latin American states

actually copied some elements of the ecclesiastical administration. Even more, the church was actually expelled from its former core site in society by the state and the market. The Catholic Church, during its more than 500 years in Latin America, has been involved in the creation of—or has indirectly inspired—numerous NGOs or FBOs. As I already said, it is still the most extended and influential organization in Latin America—not counting the state and the market. Therefore, even if we should discuss in what sense Mexico is or is not a Catholic country, we cannot ignore the Catholic Church as a factor in our analyses.

The studies including religious variables of Mexico have been increasing recently (Benjamins & Buck, 2008; Fabre Platas, 2009; Hefferan et al., 2009; Mackin, 2003, 2010; Moreno-Gutierrez & Frisancho, 2009; Oakley & Rodriguez, 2005; Ramirez-Valles, 1998; Trejo, 2009). Nonetheless, empirical data on the activities of the Catholic Church are still underused. This is particularly remarkable considering that, in Latin America, the Catholic Church, particularly in Mexico and Brazil, has the most data systematically gathered, archived, published, and even made available in electronic format. The religious—or unreligious—perspective of the researcher, always permeating the study, has probably favored an unfair treatment of these kinds of variables. Religious adscription or disbelief can be suspicious of either attacking or defending religious narratives. The issue becomes more complicated when there is a religious practice considered dominant, or at least a part of the heritage of previous or present colonial regimes; and that is the case of Catholicism in Latin America. In some scholarly environments, such practice can be a priori, and by definition, associated with the establishment and the powerful, thus considered as an obstacle for the achievement of better life conditions on behalf of the poor. There is the risk of ignoring the value of the actual research in order to test and prove the relationships of religious variables with

other social, economic, and cultural data. Some studies present dimensions of the religious practice or initiatives of lower-order clergy that foster the improvement in life conditions, but the structural and hierarchical dimensions of the church are not considered as part of the better side of Catholicism, and are not usually studied by social scientists.

The former context unveils a challenge for a project interested in the official pastoral strategies of the Catholic Church in Mexico in terms of prioritizing the population living in poverty. The action of the Catholic Church has dimensions of both support and confrontation in the interest of the poor. On the one hand, we cannot assume more than what the data show in terms of being in poor areas: having a presence among the poor does not mean popular work or meaningful social action is taking place. On the other hand, we cannot minimize the meaning of prioritizing some geographical areas, with particular characteristics, over other places in different conditions.

I already showed some important methodological limitations due to a poor understanding of the characteristics of the Catholic Church. The very selection of categories to analyze the church challenges usual approaches to other organizations. Therefore, we need to start with a basic understanding of Catholic pastoral and the theological-pastoral statement of the option for the poor—such as the framework presented here.

There are no studies directly focusing on the option for the poor in terms of pastoral care, or even evaluating if there is evidence of the option for the poor in the decisions of the hierarchy of the Catholic Church affecting the distribution of services. The only quantitative study that I am aware of about the Latin American hierarchical church, focuses on the characteristics of the bishops from 1500 to 1850, comparing countries and circumscriptions (Castañeda Delgado & Marchena Fernández, 1992).

Studies at the level of a whole country depend on the limitations and possibilities of the data to be included, and regarding pastoral work, data are available but they have not been organized before in a usable way. The Mexican Episcopal Commission of Social Pastoral has been recently studying the distribution of poverty at the municipal and circumscription levels with the objective of making society aware of the urgent problem of poverty (Cáritas Mexicana et al., 2010; Cáritas Mexicana, CEPS, & Lindavista, 2012). Nevertheless, the Mexican Catholic Church has not included data on pastoral work in their analyses of poverty, in part because my research, as part of the Project on Religion and Economic Change (PREC), has only recently finished organizing pastoral data in a statistically usable way for the first time.[3] Since the data used here were not finalized for the date of those publications, the published maps of poverty—which were created by us (PREC)—were not completely accurate in terms of geographic boundaries for the ECs and therefore also inaccurate in the distribution of other variables.

Taking into account the framework just presented, I will present the research design of my study in the following chapter. This will be the selected way for addressing the challenges identified and for giving answers to some of the questions which have been unveiled.

[3] The agreement between the Project on Religion and Economic Change and the Mexican Episcopal Commission of Social Pastoral specifies the importance of sharing this kind of data once the present research is finished.

Chapter 4: Research Design

The current discussion about the explanation of the option for the poor in the context of the social commitment of the Catholic Church in Latin America has been presented. There is still a gap in sociological study on Catholic pastoral work among the poor focusing on the spatial distribution of pastoral services in relation to the distribution of poverty. As far as we know, the once impressive social shift seen among Catholics in the seventies has not been evaluated at the level of circumscriptions and parishes.

In order to address this problem, the research design presented in this chapter will first specify the main questions and hypotheses of this research. After this, the data will be described and the strategies for linking and representing them will be explained. The following sections will present the procedures for describing distributions and testing for autocorrelation, and it will test the null hypotheses through statistical models.

The strategies for gathering, linking, representing, and modeling different kinds of data have been developed and tested as an important task of the Project of Religion and Economic Change (PREC, 2010; Woodberry et al., 2010).

4.1. Research Questions

The study about the preferential option for the poor in Mexico, in terms of pastoral care, leads to several possible questions. In the long term, we want to know if provision of pastoral care has been shaped by socio-economic conditions in the last decades, and if the statements about the option for the poor fostered this. From there, we will have the conditions to analyze if the pastoral care has had any influence on the living conditions of the population, and if it has made any difference. But before that, we should first establish a valid way to describe and measure where the Catholic Church has been providing more pastoral care and also describe and measure the characteristics of the

population located in such places. We should begin with the analysis of cross-sectional data from a particular time point—before any longitudinal study—and find if there is more pastoral service in poorer areas, considering different dimensions of poverty. Since there has not been empirical research about this specific topic, we still wonder if there is a trend, or common characteristic, in the places actually receiving more pastoral care, or if the Catholic Church's attention is randomly distributed to different areas, no matter their social and economic characteristics. Therefore, for this proposed study we establish that our first goal is to answer the question:

Is there empirical evidence of the Catholic Church prioritizing the pastoral service to the poorest population of Mexico?

In order to answer the question we need to clarify and operationalize the basic concepts. In the first phase, this research will use aggregated geographic units of analysis. Although variables and procedures will be explained in more detail later, we will start by presenting a first understanding of:

- Catholic Church
- Pastoral service
- Poverty
- Empirical evidence of prioritizing

The Catholic Church, in this case, is understood as the worldwide hierarchical organization made up of basic, territorial administrative units known as Ecclesiastical Circumscriptions (ECs).

The pastoral care or pastoral service is the main goal of the church as an organization. This activity actually defines the Catholic Church according to its own theological teachings. Even if it involves several dimensions, the variable can be operationalized and measured in terms of works and personnel. The number of parishes

per each territorial unit of analysis will be the measurement used in this study as the proxy for measuring the provision of pastoral services.

Poverty, as has been explained, is a multidimensional phenomenon more complex than the mere limitation of goods and economic resources, although it also includes this. This research will consider five dimensions of poverty:

- limited ownership of material possessions
- limited access to utilities and urbanization
- limited access to health services
- limited level of education
- marginalization because of ethnicity

All measurements will correspond to aggregated values in a geographic unit of analysis; also, the five percentages will be averaged to have a simple aggregated index of poverty. The first two measurements evaluate life quality in the household; the other three aggregate data from individuals. The ownership of material possessions will be measured by the percentage of households that do not have a car, washing machine, refrigerator, phone, cell phone, internet, computer, television, or radio. The percentage of households without running water will be used for measuring access to utilities and urbanization. Access to health services will be represented by the percentage of the population without any public or private health service plan (as will be explained later). Level of education will be measured by the percentage of the illiterate population aged fifteen years or more. Marginalization due to ethnicity will be measured by the percentage of the population speaking an indigenous language.

The empirical evidence we are looking for would be the coincidence—correlation—of more parishes where there is more poverty and marginalization.

Both pastoral care and the different dimensions of poverty will be measured at

different geographic levels of aggregation, which will be explained in detail. We can easily guess that the analysis of each level could lead to different results, as we will also detail when referring to the Modifiable Areal Unit Problem (MAUP). The data used here are always found in different levels of aggregation. This situation makes it even more pertinent to include a methodological question in addition to the empirical question, due to the complexity of the available data:

How consistent are the different levels of aggregation
on the priority of the poor for the Catholic pastoral work?

This second question is relevant in order to understand the advantages and limits of an eventual integration of historical data for longitudinal analyses. To clarify this question, I should say that:

- The levels of aggregation are understood as the different geographic units of analysis of the data. Therefore, *levels*, *units of analysis* and *units of aggregation* are interchangeable wordings in this research.
- Consistency is defined as the coincidence regarding sign (positive or negative), statistical significance, and relative magnitude of the coefficients among the different ways of modeling the data.

Results will be stronger when they are similar at different levels of aggregation. When consistency is not observed, the main reasons for the differences will be found and explained. The results of this question will enlighten the best ways to proceed when dealing with historical data which are not always as detailed as the data currently available.

4.2. HYPOTHESES

Regarding the empirical question, we hypothesize that pastoral care will be

positively correlated with five dimensions of poverty and the aggregated poverty index:

- H_0: Pastoral care is negatively, or not, correlated to poverty
- H_A: Pastoral care is positively correlated to poverty

The null hypotheses to be tested at the different levels of aggregation of the data, taking into account the already mentioned five dimensions of poverty plus the aggregated index, can be specifically stated as:

- H_{00}: The number of parishes is negatively, or not, correlated to the aggregated index of poverty.
- H_{01}: The number of parishes is negatively, or not, correlated to the percentage of households without material possessions (such as a car, washing machine, refrigerator, phone, cell phone, internet access, computer, television, or radio).
- H_{02}: The number of parishes is negatively, or not, correlated to the percentage of households without running water.
- H_{03}: The number of parishes is negatively, or not, correlated to the percentage of individuals without a health service plan.
- H_{04}: The number of parishes is negatively, or not, correlated to the percentage of the illiterate population aged 15 and more.
- H_{05}: The number of parishes is negatively, or not, correlated to the percentage of the population speaking an indigenous language.

It is crucial to remember the importance of controlling for the most important factors that we are aware of and that could be correlated to poverty but are pulling up by themselves the number of parishes or are correlated to the number of parishes and hiding their relationship to poverty. In other words, appropriate controls will be necessary to avoid hiding results or finding spurious correlations.

4.3. DATA

The data for this research was gathered as part of the Project of Religion and Economic Change directed by Dr. Robert D. Woodberry (www.prec.com). In the Project we have been gathering data corresponding to the pastoral services provided by Christian churches since the 19th century in Africa, Asia, Oceania and Latin America. We accessed—among other sources—yearbooks and directories of the Catholic Church, such as the Mexican Church Directory (ArDPM, 2010) and the Pontifical Yearbook (AP, 2010, 2011, 2012). We have also been collecting data on censuses for the countries of the regions we are studying. In the case of Mexico, there is a particular richness in the availability of data. We gathered materials from the National Institute of Statistics and Geography of Mexico (INEGI, Instituto Nacional de Estadística y Geografía). The data from INEGI include census variables of the 2010 General Population and Housing Census at the level of localities (INEGI, 2011c) and the digital map of political boundaries in 2010 (INEGI, 2011a). The research questions and the available data point to the selection of particular variables to be included in the analysis. In general terms, the dependent variables measure pastoral activity, whereas both independent variables and controls measure socio-demographic conditions. The data that were chosen for this project, according to the research proposal, corresponded to the 2000 Mexican census—because the data for the last census were not available yet—and did not include the last publication of the Annuario Pontificio. When new data were available, I gathered them to be used in this research and to be integrated into the PREC database.[4]

[4] For a more detailed description of the data gathered into the PREC database, see the Technical Document (Woodberry et al., 2010).

Measurements of Poverty

The relevance of measuring multiple dimensions of poverty to approach the identification of poor areas at different levels has already been presented. We have a main limitation because our broad longitudinal study depends on data available from censuses, which usually do not include questions on income, values, aspirations, or goals. In contrast, the census variables used in this research have the advantage of being present in similar formats in historical data coming from former censuses of Mexico. Some of them have differences in the age ranks to be considered, but that is a minimal problem once the variable can actually be found. This will make it possible to complete the research in the future.

The five selected dimensions help us to approach a more complex concept of poverty and marginalization. They seem to be "valuable," to ''combine scope with specificity," to "be 'critical,'" and to not be restricted "to one view of the good life." The main limit of these dimensions is that they, even being the best from census data, cannot be considered as "complete" (Alkire, 2002, pp. 98-99).

We noticed that the Latin American Catholic Church has used diverse meanings of poverty depending on different theological perspectives. Nevertheless, the concept usually includes a socio-demographic connotation which encompasses different kinds of limitations of resources, and of marginalization as dimensions of poverty. Therefore, the measurements also satisfy an intra-organizational perspective as much as the broader social scope.

Limited Ownership of Material Possessions

The most common measurement of poverty, in economics, refers to income. Income is usually included in the measurement of poverty, although there is an increasing agreement in its limitations and the convenience of more comprehensive measurements.

However, limited income is a dimension which cannot be ignored, but it is important to consider that “the census has not been designed as an instrument for the collection of data on income” (López-Calva et al., 2007). Besides, available disaggregated data do not include such a variable. Therefore, the deprivation of material goods will be used as a proxy for measuring material poverty.

The Mexican census asked in each household if they have a:

- Car
- Washing machine
- Refrigerator
- Phone
- Cell phone
- Internet access
- Personal computer
- Television
- Radio

The questions address material goods such as the radio receiver, the TV set, or the personal computer; they also ask for appliances such as the refrigerator and the washing machine. A question asks about a vehicle, whereas other questions refer to services such as internet access, cell phone service, or a conventional phone line.

Besides the variables for each question, there is a variable for the total number of households not having any of the listed goods (*viviendas particulares sin ningún bien*). Although there are some services implied in the list, notice that INEGI actually connects the measurement to the lack of material goods. Based on this, the variable will be used for measuring material poverty.

The variable to be described and used in the models is calculated by dividing the

total number of households without material goods by the total number of households (*viviendas particulares habitadas*), after aggregating the data at the different levels; the result is multiplied by 100 to get a percentage between 0 and 100.

Limited Access to Utilities and Urbanization

The measurement of well-being, as a dimension of poverty, can be understood in terms of access to basic services and resources (Alkire & Santos, 2010a, 2010b). The census gathered information about the availability of running water inside the household. Deprivation of a basic utility such as running water indicates limited access to basic services and to the advantages of urbanization, although it could also happen in poor sectors of urban areas.

The variable is calculated similarly to the deprivation of material goods. Once the data are aggregated at the corresponding level, the total number of households without running water (*viviendas particulares habitadas que no disponen de agua entubada en el ámbito de la vivienda*) is divided by the total number of households. Results are multiplied by 100 to get values between 0 and 100.

Limited Access to Health Services

Some of the most common measurements of multidimensional poverty focus on health conditions (Alkire, 2002; Alkire & Santos, 2010a; Siggel, 2010). A common way of measuring this is calculating mortality rates, and particularly child or infant mortality rates. Nevertheless, the data for estimating child mortality from children ever born and children death—by five-year age groups of women—are not available in Mexican censuses before 1990 and at the locality level are not even available for 2010. Even when mortality or other measurements of health are available, the best predictor of health conditions in Mexico has been the right to have access to health services

(*derchohabiencia a servicios de salud*).

The census question for *derechohabiencia* is explained by IPUMS-International (Minnesota Population Center, 2011) as a variable that "reports whether the person had medical coverage (or a right to medical services) from a public or private institution." According to Mexican legislation, every worker should have medical coverage. Besides those having medical coverage because of their employment, other people can use "out-of-pocket financing, or [rely] on some other private or regional program." In addition, since 2006, the legislation on Social Security guarantees the coverage to the population in extreme poverty, including indigenous and poor families from rural areas, through "a new public insurance program (*Seguro Médico para una Nueva Generación*)." Nevertheless, there is still a gap between the law and the access; and the right to access health services, as reported in the census, is a good proxy for measuring health vulnerability and deprivation of good health conditions.

I refer to this *derechohabiencia* as the right to access health services or as having a health service plan indistinctly. The variable to be used in this research is calculated dividing the total population without such right by the total population of the corresponding unit of aggregation of the data (then as usual, the result is multiplied by 100 giving values from 0 to 100).

Limited Level of Education

Level of education is also one of the most commonly studied dimensions of poverty (Alkire, 2002; Alkire & Santos, 2010a). Although mean or median years of school have been among the best traditional indicators of educational development, they require microdata in order to be aggregated, and such data are not available before 1990, and after that aggregated data from the sample are not meaningful at the locality or the

municipality levels. Even if less commonly used, literacy is also a proxy for measuring educational disadvantage and education marginalization.

The census asked about the literacy of individuals who were 15—or more—years old. The variable to be included in this research divides the total illiterate population aged 15 years or more (*población analfabeta*) by the total population of that age range at the corresponding level of aggregation. As usual, to get values from 0 to 100, the result is multiplied by 100.

Marginalization because of Ethnicity

It has been shown that indigenous people have historically been marginalized in Mexico and in the whole of Latin America (Gonzalez de Alba, 2010; Holden & Jacobson, 2009; Hopenhayn, 2003; OPS, 2001; Trejo, 2009). Thus, ethnicity is a main dimension of poverty. The Mexican census does not ask for ethnicity or race, but it has traditionally asked the individuals if they speak languages other than Spanish, and particularly if they speak an indigenous language. This variable has been traditionally used as a proxy for identifying the indigenous population.

As a proxy for marginalization due to ethnicity, which is another dimension of poverty, the research will use the result of dividing the total population aged 3 years and older who speaks an indigenous language by the total population in the age rank, for each aggregation level of the data. As in the other variables, results are rescaled 0 to 100.

Aggregated Index of Poverty

The five dimensions included in the research broadly correspond to the suggestion of Alkire (2002, p. 186) regarding the dimensions of human development: they are non-hierarchical, irreducible, and incommensurable. They could correspond in general to the experience of poor sectors. Although this assumption is consistent with social work in

Mexico—and my own former experience in that—it still needs to be tested in future research.

We can build an index of multidimensional poverty by adding the five measurements—percentages—of different dimensions of poverty and dividing them by five. The index will also have possible values from 0 to 100, although it will have less dispersion because of the highest or lowest values.

When microdata are available, a usual way to identify population with higher disadvantages because of poverty is to add different dimensions of poverty in order to know who has two, three, or more kinds of vulnerability. Since the broader historical research, and this research as part of it, uses aggregated data, dimensions cannot be added in the same way, but it is still possible to average the five measurements in order to calculate an ad hoc aggregated index of poverty. This index has limited power compared to the study of multiple dimensions. When addressing both the needs of the poor or the challenges of poverty, it is much more important to focus on the different dimensions in detail. Nonetheless, a unique measure can be useful to synthesize them in a variable which could also be modeled to test our hypotheses.

Measurement of Pastoral Service

The number of parishes will be used in this study as a proxy to measure pastoral service. Parishes have already been presented as the main centers directly offering pastoral care (C.I.C., c. 374, 515-518). The list—or at least the number—of parishes is the most commonly reported characteristic of ecclesiastical circumscriptions (ECs) in different sources such as yearbooks, directories, or reports to the pope. This shows the relevance of parishes in terms of pastoral services.

Of course, pastoral services for the poor cannot be reduced to the number of

parishes. The preferential option can also be shown in the number of pastoral agents sent to work in poor areas or in the pastoral strategies and programs prioritized. This number shows the general attitude of the organization towards the community in general and the poor in particular. Nonetheless, a parish has geographic coordinates, and when it is located in any particular area, we can assume that such a place has been given priority over other possible places. Although limited, these data are strong measurable evidence of the priorities of pastoral work. Nevertheless, they have seldom been used for statistical analysis, if ever.

The number of parishes has been the most challenging and time consuming variable to be coded. The sources used by PREC in order to find out the number of parishes in December 2009 at the different levels of geographical aggregation are mainly the Mexican Church Directory (ArDPM, 2010), and three editions of the Pontifical Yearbook (AP, 2010, 2011, 2012). Nevertheless it was also necessary to use the digital map of political boundaries in 2005 and 2010 (INEGI, 2011a), the 2010 General Population and Housing Census at the level of localities (INEGI, 2011c), and the previous list of municipalities classified by ECs used by the Mexican Episcopal Commission of Social Pastoral, among many other resources. The task involved the participation of many research assistants from PREC and also personnel from the General Secretary of the Mexican Conference of Bishops. The process took place from July of 2009 to June of 2011 and from February to May of 2012.

The starting point was the digital version of the Mexican Church Directory published in 2006, and then the list was completed using the Directory of 2009-2010 to get a total of 10,767 churches. Using the data from the census of 2005, we started matching each of the churches to an official locality listed by INEGI. When the results from 2010 were published, we updated the dataset and reclassified all those places not

found in the list of 2010—about 400—since localities which disappeared in the most recent census are less likely to have a church.

The dataset of churches included an alphanumeric field labeled as municipality, which actually has the name of the neighborhood, town, city, or municipality where the church is located. (These names could also be traditional or older names not recognized as official names by INEGI.) We merged both urban localities and rural localities from the official map of Mexico and we produced a complete list of official names and codes for localities, municipalities and states. That made it possible to match the name in the directory to the name of one of the 192,245 official localities of Mexico. Some of the 2,456 municipalities are called by the names of their capitals, and we were able to do an automatic matching for about 30% of the churches listed in the directory; another 20% were matched directly to the name of the municipality or the name of a locality, usually the capital. Over 5,000 churches were manually matched to the most plausible locality. The main challenge was that there was usually more than one possible name to be matched, even in the same municipality. Therefore, we used the census data to prioritize the most populated localities, which are more likely to have a church. We also used the official datasets of zip codes (*códigos postales*) and area codes (*claves lada*) to identify the locality when such information was available in the directory. After months of collective work to match all the churches to an official locality, we checked if the municipality where the locality belonged had been previously classified as part of the EC. If not, we did extra research to find out if there was more evidence that the municipality split into more than one EC. After identifying with pretty good precision the localities of the churches, we represented them on the digital map of Mexico and visually validated if each one of the 91 ECs was represented as a contiguous territory with more or less identifiable boundaries: the points and polygons—representing rural and urban localities

respectively—where one or more churches are, should be displayed in the digital map with relative contiguity. The most complicated situation was the city of Tlalnepantla (a locality represented as a polygon), in the municipality of Tlalnepantla de Baz, in the state of Mexico, which splits into three different dioceses: the diocese of Ecatepec, the archdiocese of Tlalnepantla, and the archdiocese of Mexico.

Once the matching procedure for the churches was finished, we had to identify the parishes or quasi-parishes. The goal was to include in the variable all the churches that offer pastoral services in a relatively basic but complete manner. The directory capitalizes most parishes and quasi-parishes but many of them are not capitalized. The total number of parishes includes:

- Any church with its name in capital letters
- Churches labeled as *parroquia*, *cuasiparroquia*, or *catedral*
- Churches labeled as *vicaría fija* or *vicaría subsidiaria*
- Basilicas
- Pastoral centers or pastoral zones
- Mission stations

The schismatic parishes or those belonging to non-Latin rites —the Maronite and the Melkite—were excluded from the list, since they follow a different dynamic and do not fall under the jurisdiction of the ECs of the Latin Rite.

Since we wanted to make an accurate list of parishes on December 31st of 2009, the final number of parishes was compared to the numbers published in the Annuario Pontificio from 2009 to 2012. If numbers had differences of more than 10% of their value or more than 10 parishes, other evidence was gathered in order to identify the correct number of parishes. This quality control helped to clean data and exclude some churches that were not parishes but capitalized by mistake. The most serious problem, at the end,

was that we found four ECs with a number of parishes higher than the totals reported in the Annuario, but we had enough evidence to suggest that the directory had more updated and accurate data.

Once PREC's list of parishes has been validated, the variable to be included in this current research aggregates the number at the corresponding level of analysis. The first aggregation is at the locality level in order to have data at the same level of the maximum disaggregation of the census dataset to be used.

Other Measurements to be Included

The relevance of control variables to be included in the models has already been explained. Even if there is a correlation between pastoral service and poverty, we must be aware of different mechanisms of such a relationship, which will not necessarily imply an actual preferential option for the poor in terms of pastoral care. For example, we should consider that more pastoral service can be provided where more Catholics are located, in areas of higher religious competition, or in places surrounded by more parishes. It could be that parishes are in the most urbanized areas, but it is also possible that controlling for urbanization reveals the priority of poor areas. In other words, appropriate controls will be necessary to understand mechanisms, clarify relationships, and avoid spurious correlations.

Total Population

We can assume that the most populated of the localities would also have more parishes net of other factors: the likelihood of having a parish is directly correlated to the population size. This can be considered a measurement of the exposure to the "risk" of having a parish in the correspondent unit of analysis.

The variable to be included as exposure in the models is the natural logarithm of

the total population, at the corresponding level of aggregation of the dependent variable.

Non-Hierarchical Catholic Presence

We will be modeling an outcome related to the hierarchical and structural dimension of the Catholic Church. Other than the hierarchy, all those who identify themselves as Catholics are the Catholic Church. Therefore, the non-hierarchical presence of the church should be one of the most important controls to be used. We would naturally expect that pastoral services tend to correspond to the size of the Catholic population demanding for them. It has been considered that Latin American Catholicism is more a cultural use than a religious choice, and committed Catholicism would be better measured by active participation in the church. Nevertheless, if the individuals are still claiming Catholic identity, we cannot minimize that. As a control to be included in the models, we will use the total number of Catholics divided by the total population of the unit of analysis. As usual the percentage will be rescaled (0 to 100).

Religious Competition

Although the total number of Catholics can be positively correlated to the number of parishes, the case can also be made that the mechanism works in the opposite direction. The theoretical claim about the option for the poor being a strategy of religious competition, would lead us to expect more pastoral care as a reaction to the increasing number of former Catholics converting to other Christian alternatives. Although we can use measurements of religious diversity as a proxy for competition, the main competition that we want to control corresponds to other Christian groups or churches; therefore, the size of the population who can be broadly defined as Protestants seems to be a convenient measure. The census variable aggregates historical Protestant churches, Pentecostals, Neo-Pentecostals, Evangelicals, Christians and Schismatic Christians (as Jehovah's

Witnesses and Mormons). Although diverse, all of them could be understood from a Catholic perspective as competing religious options.

The measurement to be included in the models will divide the total number of broadly construed Protestants by the total population of the unit of aggregation, rescaling the result to correspond to other percentages going from 0 to 100.

Since this variable is highly correlated—inversely—to the percentage of Catholics, it will be better to include one or the other unless an important reason is discovered for including them both.

Limited Urban Infrastructure

The lack of the advantages of urbanization has already been considered among the dimensions of poverty and it has also been mentioned that such limitation can also be experienced in urban environments. However, net of such a dimension of poverty, higher population density and the infrastructure usually associated with that can increase the likelihood of establishing a parish. Therefore, it is important to control for local urbanization in order to reveal the net correlation of pastoral services and poverty. We can classify the localities as urban and rural, following INEGI in the criterion of considering the locality urban if it has more than 2,500 inhabitants (INEGI, 2005, 2008a). In the models, a dummy variable for the classification can be directly included at the locality level. At other levels of aggregation it would be possible to calculate the rate of rural localities, but this would probably overweight many tiny settlements. Thus, it seems more meaningful to weight the rate by the population size. This means that the number of inhabitants in rural areas is divided by the total population. The results measure the proportion of rural condition in terms of population. As usual, results are rescaled—from 0 to 100—as all other percentages.

Spatial Context

The last—although not least—important control to be included addresses the problem of spatial autocorrelation (which will be explained in detail). It is possible that parishes are established close to other parishes, but the mechanism could also work in the opposite direction and parishes could be created in areas where there is more need of them because of the lack of neighboring parishes. In both cases, the measurement of neighboring context could help us to better understand the mechanism.

The average number of parishes in the neighboring units is the measurement to be included in the model. We use the centroid of the unit of aggregation for measuring the distance among neighbors. The thresholds for including a point as a neighbor for the ADPIs (150 km) and for the MxHCGUs (250 km) come from rounding up to the closest 50 km the threshold from the test for spatial autocorrelation. In both cases they seem plausible distances for human, social and cultural interactions at the level of parishes and municipalities respectively. The threshold for ECs is hypothesized to be considerably bigger because it implies relationships of the bishops with other bishops in order to shape their pastoral strategies. Therefore, the threshold is calculated from the Geographically Weighted Regression (GWR) and it is almost 1,000 km (955.6).

4.4. DATA PROCESSING

The variables come from different sources and have different levels of aggregation (as shown in Figure 3). This situation adds complexity to our research because we need creative ways to put together the data in order to measure the evidence about the option for the poor.

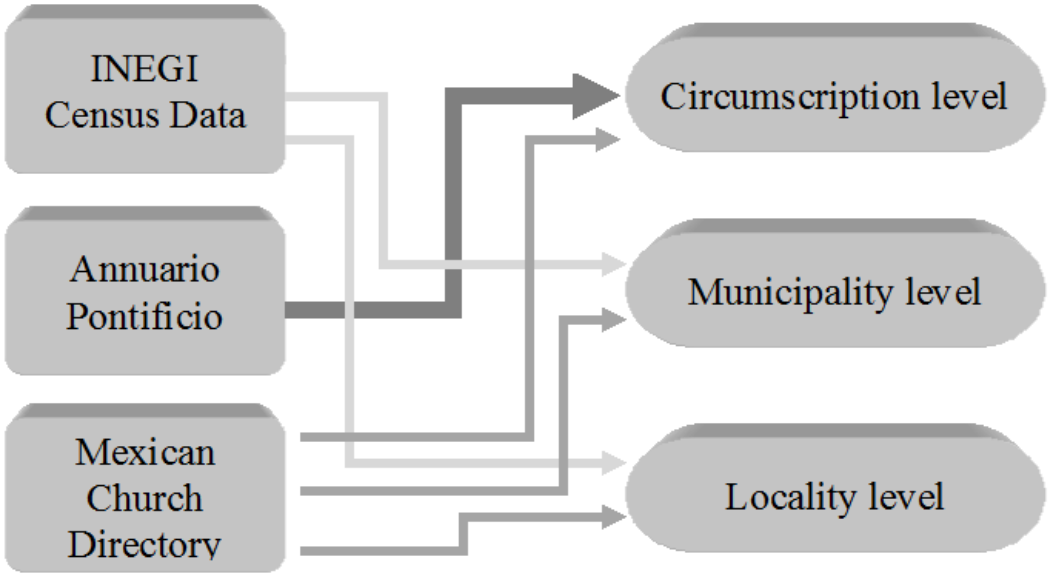

Figure 3: Different Levels of Aggregation of the Data.

We consider that the localities included in the results of the 2010 Mexican census are the basic level of aggregation of our data. INEGI considers that a locality is a settlement of one or more houses (even if they are uninhabited) acknowledged by law or by custom, and can be distinguished from another settlement. It could be as small as a household or as big as a huge city (INEGI, 2005). The inhabited localities included in the census could have from 1 person to more than 1.8 million people. Of the 192,245 listed by INEGI, 310 were dropped from this study: 230 were visited during the census but it was not possible to gather any data (for those places there is only an estimated total population and total number of households); 79 localities have incomplete data for the measurements we are using; 1 locality is not included in the digital map. Therefore, our analytical sample includes 191,935 localities.

The dataset includes detailed information for all localities with three or more

households. However, 3.6% of the population lives in 43% of the localities (84,460) that have one or two households.[5] The data for those localities are aggregated by municipality and by number of households—one or two—although the total population of the locality is reported. In order to be able to aggregate the data at different levels, the counts were distributed based on the population size, assuming that all localities of one household—or two households—in the municipality would have similar distributions among them. The strategy of distributing data based on the population seems fair enough and will also be used for historical data because we usually have the population by locality even if every other measurement is aggregated by municipality. Once parishes have been matched to the proper locality, the data on pastoral service can also be summarized at such level.

Data, of course, can be aggregated in bigger units of analysis. Here is where we face the Modifiable Areal Unit Problem, or MAUP (Dark & Bram, 2007; Stephan, 1934; Unwin & Hepple, 1974). The problem is that different levels of aggregation can lead to different, or even contradictory, results. For example, different ways of grouping the data on 99 counties in Iowa resulted in coefficients of correlation ranking from -0.97 to 0.99, between the percentage of elderly voters and the percentage of Republican voters (Openshaw & P., 1979). Data are often aggregated in arbitrary—modifiable—ways depending exclusively on the decision of the researcher. Therefore, it is important to consider the basis and the meaning of different levels. Even if data are available for some limited kinds of aggregations, we should consider if such levels are also the best for doing research, testing hypotheses, and showing results. We are limited by the availability of sources, but we still can test how the available levels make sense and correspond to each other.

[5] Disclosing data about the smallest localities is against privacy.

We should remember that for measuring pastoral services, the basic proper units of analysis are circumscriptions and parishes. In fact, we stated that ignoring these aggregations would lead to inaccurate or even biased results. Nevertheless, in terms of socio-demographic data, an important and usual unit of analysis is the municipality. Whereas localities are not administrative units, but settlements of population, municipalities are the minimum territorial independent administrative units according to the Mexican law (Arnáiz Amigo, 1977; LOAPF, 2009; Palacios Alcocer, 1987). Municipalities have defined territorial borders encompassing one or more localities (about 78 in average, ranking from 1 to 1,709). Municipalities in Mexico vary not only in the social and economic conditions of their localities, but also in the different ways of spending their own budgets. Many issues related to official policies to alleviate poverty could vary not only by state, but also by municipality, because each one has its own government capable of decisions regarding social and economic issues. Therefore, the inter-municipal variation has not only empirical, but also legal, foundations, and therefore, this has been an important level to analyze poverty and marginalization from a sociological perspective (CONEVAL, 2007a).

Nevertheless, to be measured in relation to pastoral services, it is necessary to aggregate municipalities by ECs. Dioceses and archdioceses are the most common kind of ECs in the Latin American context, and because of their colonial past they are highly coincident to the borders of civil administration units. In Mexico, ECs include an average of 27 municipalities, although the rank goes from 1 to 332. Although highly coincident to ecclesiastical borders, municipalities sometimes split over two or more ECs. The official list provided by the Mexican church acknowledged 10 municipalities in this situation, but after completing the data cleaning, we have been able to identify 32 of them.

We needed a strategy to divide the municipality in order to correspond to the

aggregation by ECs. This situation gets more complicated when going back in history because some part of a municipality could have been part of another municipality or another EC in the past. Therefore, we decided to identify each one of these pieces and call them Maximum Historically Consistent Geographic Units (MxHCGUs). We looked for the maximum area that could be considered as an undivided unit throughout the time of interest of our study. If a municipality belonged to one EC and it always had the same territory in the context or during the study period, it became an MxHCGU; if it was divided, each sub-municipality became an MxHCGU.

The MxHCGUs are based on the official digital map of INEGI because it is extremely detailed and because we know that in most cases the ECs follow the municipal borders—this is the same map that was used to validate the location of parishes. Once we know that a municipality splits into more than one circumscription, we project the map including points for localities and polygons for municipalities.[6] The spatial distribution of localities (points) with churches can show a pattern for a plausible division of the area with no other points in the middle (Figure 4, upper section). It is also possible that points having churches are surrounded by many other localities without a clear identification of the EC they belong to (Figure 4, lower section). In order to get a more detailed classification of the localities in terms of ECs, the PREC research assistants called many parishes to ask the pastors about the places where they provide pastoral services. This info was used to classify the localities without churches in order to trace the borders (Figure 4, lower right side). The less populated localities are possibly unknown, even by the pastor; in such case, they were assigned to an EC using other sources and considering

[6] Although I tested the use of Thiessen polygons to distribute the territory, the results were inaccurate and I opted for the manual division of the polygons.

the general shape of the borders (known or projected by the points), the proximity to known roads-networks, and the distance from the already assigned localities.

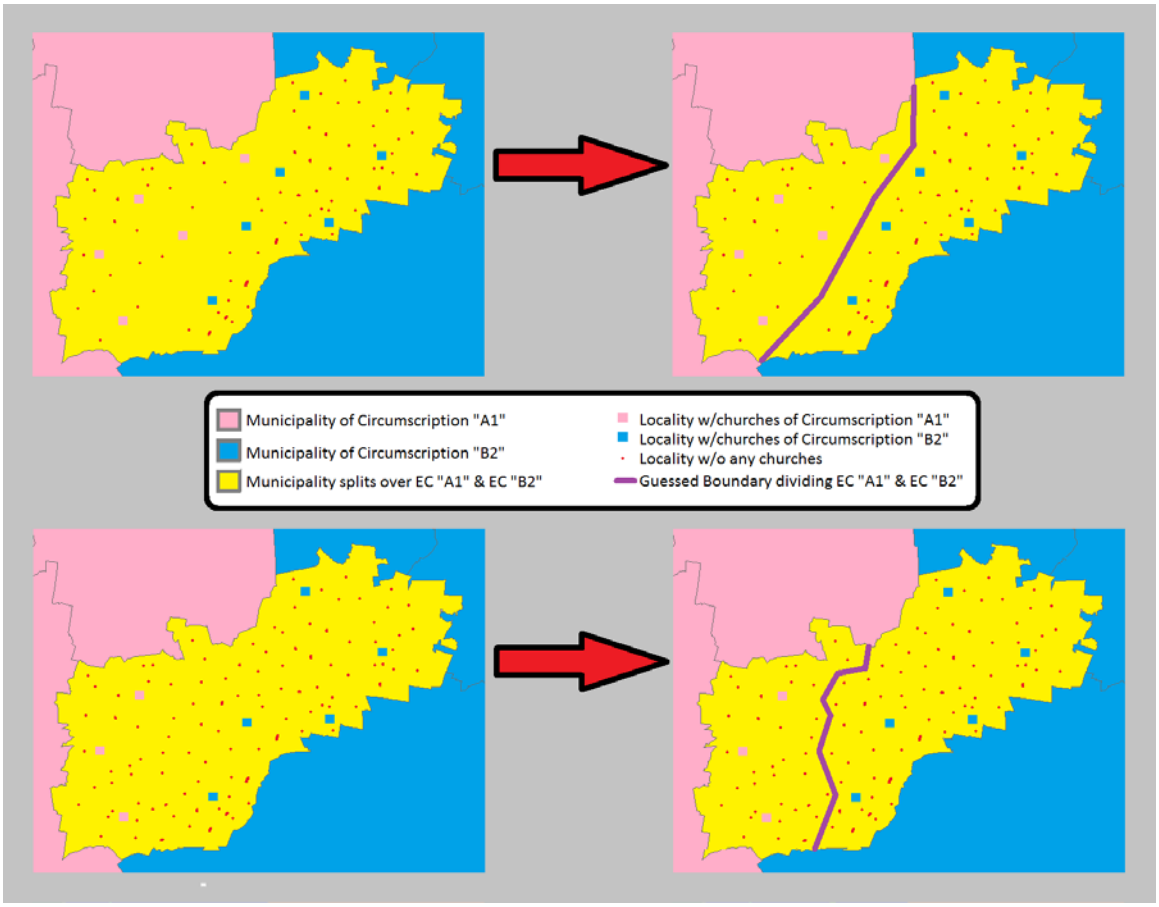

Figure 4: Division of Municipalities to Create MxHCGUs.

The 2,456 municipalities are currently subdivided into 2490 MxHCGUs. At the end we will be able to have the most accurate distribution of the localities in the ECs and a very precise map in terms of population—even if inhabited areas could have some random error. This map would be even better than the official maps that we have already made in PREC for the Mexican Conference of Bishops (Cáritas Mexicana et al., 2010). When we add historical data, we will create earlier borders with combinations of current

borders, or we will reconstruct the border, either from legal documentation (i.e., the border follows “Hg*z7v8” river or the crest of “Jm8&^mw” mountain range), or from a digitized version of an old map. Each new border will divide a polygon in such a way that we end with two datasets. One is the set of all the municipalities encompassed in the basic map we used, and each one is made by one or more sub-polygons. The other set includes all the sub-polygons called MxHCGUs. We give each MxHCGU a unique ID. Because we have already constructed a “family tree” of all border and name changes in Mexican municipalities and circumscriptions, we will be able to easily reconstruct the shape of any geographic unit of analysis, at any date, by joining MxHCGUs.

MxHCGUs are the basic tool for aggregating data by municipality or circumscription. They are particularly powerful for historical data, which are usually limited to the municipality reference and rarely mention localities. However, this cross-sectional analysis has the richness of more disaggregated data which we could also exploit.

The parish level is the smallest geographic unit we are dealing with, but it has some limitations for the analysis. Parishes in rural areas can include several localities in their boundaries and even more than one municipality, but in urban areas we can find several parishes in only one locality. However, we do not have a complete map for current boundaries of the parishes, and we usually do not have historical records for the changes of those boundaries. Such boundaries—particularly in urban areas—have usually been unstable and sometimes not completely defined, and people can easily move around and access services from a parish even though they do not live within its jurisdictional territory.

Even if we knew the boundaries for all the parishes, such level would not be coincident to census tracts or other aggregation of socio-demographic data. In contrast,

data—including number of parishes—can be aggregated by locality. Localities can have one parish, more than one, or none at all. This is convenient because we need a small unit of aggregation to identify marginalized populations located in small areas. This aggregation works for the 4,527 urban localities that have infrastructure and accommodate for people's mobility. Although in rural areas, parishes are more likely to be in the most populated places, it does not make sense to deny the parish influence in neighboring places. The influence does not even have to be coincident to the jurisdictional territory of the parish. Besides, even if localities are more stable and identifiable, the small size of many localities facilitates a highly problematic number of zero values not only in the outcome, but also in some predictors. Therefore, we need here another tool that would include the area under the influence of the pastoral service, which we call the Area of Direct Pastoral Influence (ADPI).

We calculate such area creating a threshold around each locality having one or more parishes. For rural areas, the threshold includes all those neighboring localities that are within walking distance from the parish. The walking distance was estimated to be 3 km, which could be walked by a Mexican peasant in a little more than a half hour but less than an hour, on average. Therefore, they could visit the parish relatively easily. For urban localities, since their area could sometimes include the 3 km, we added half the square root of the area of the polygon representing them, because that would assume a square shape and would add the distance from the center to one side plus the measurement of the threshold. This is because we do not expect to have parishes located in the extreme perimeter of the urban area. When a locality falls into more than one threshold, it is assigned to the closest parish.

By using the ADPIs, we can estimate if there is a trend for concentrating parishes in areas with higher measurements of poverty. However it is highly desirable to include a

set of comparable units that could help us to understand if the parishes are prioritizing the poor in general terms. There is strong evidence about the validity of ADPIs as a unit of analysis, but the aggregated areas of reference need to be arbitrarily constructed. After testing different cutoffs, I discovered that the closest distribution in terms of total population was when we used as nodes those localities, without churches, of 250 inhabitants and more. Around the nodes we also built a threshold of 3 km. For those urban localities without churches, I assumed a circular shape and added the radius plus the threshold. This is to give a slightly longer area of influence, since the node would work in terms of cultural environment, not in terms of the distance for accessing a church.

The former discussion on the units of aggregation is the basis for my decision to include in the analysis only the levels of ECs, MxHCGUs and ADPIs. Regarding ADPIs it could be useful to approach them with and without including the other areas of reference. Modeling the data at the level of localities introduces too much noise in the regressions and poverty is never significant; therefore, we omitted such models from the results. Nevertheless, it would be useful to have some descriptive approach to the level of localities. Given the particular situation of the huge amount of very small localities, it seems convenient to add a further distinction in two datasets: one including all localities and the other excluding smallest places. We will distinguish those having fewer than 250 inhabitants from those with 250 and more, which is the same cutoff used for the areas of reference without a parish.

The process of linking and aggregating data described here is possible due to the infrastructure provided by the maps. Poverty maps have already included variables from different sources (such as censuses and surveys), but the integration of data usually reported by different units of observation is a challenge that has not been addressed

before in the literature, except for the work of PREC. This challenge requires more sophisticated ways of organizing the map in minimal units, which should also include ecclesiastical borders. In this project, maps are a tool for distributing the data in comparable units of analysis and to analyze them—not only for representation and communication. Variables are aggregated in geographic units of analysis and we can put together data from different sources and compare results at different levels (Figure 5).

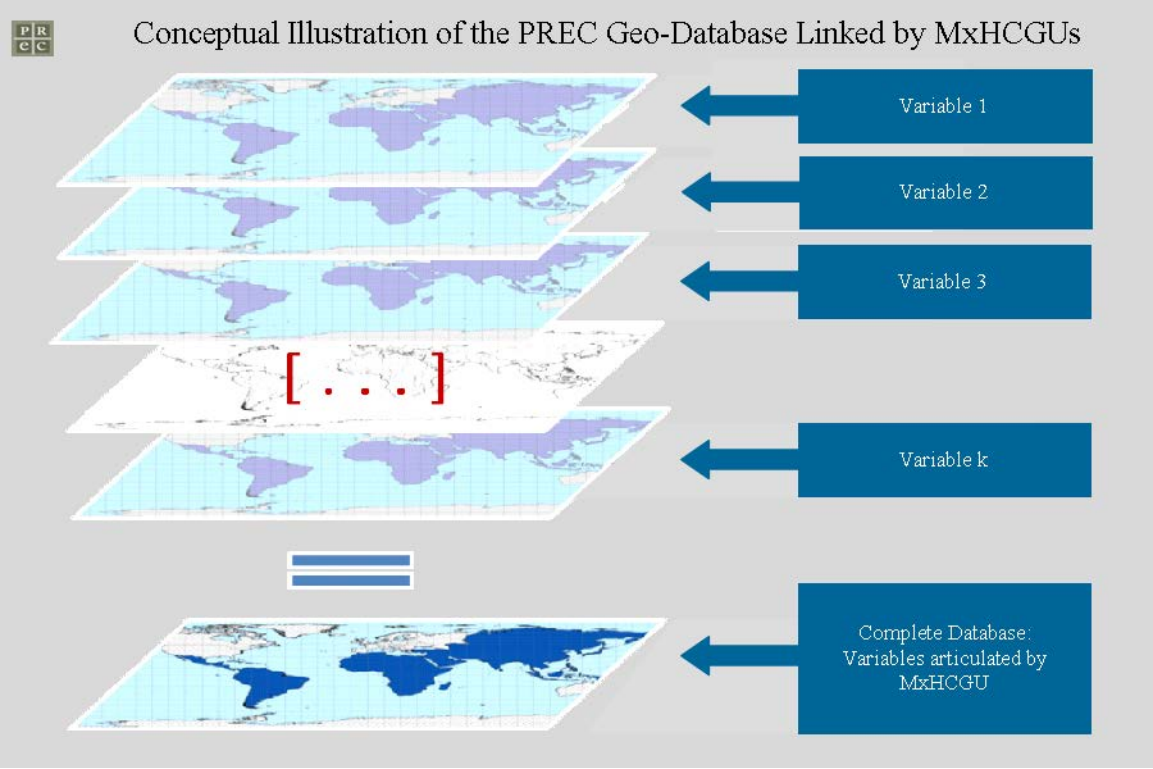

Figure 5: Integration of Variables from Different Sources.

The final maps improved significantly the quality of preliminary analyses by a precise division of municipalities in MxHCGUs and the validation of geocoded data for parishes. The higher quality data will facilitate more meaningful descriptions and more reliable models. The following section will complete the research design by showing how

we can describe and analyze the data using the GIS platform based in the ArcInfo software (ESRI, 2009) interacting with statistical procedures in Stata® (StataCorp., 2009a).

4.5. DESCRIPTIVE ANALYSES AND TESTS OF HYPOTHESES

Spatial Distribution of the Data

We will start the data analysis by describing the distribution. Since we are dealing with geographically-referenced data, it is convenient to include indicators of the spatial distribution among the descriptive statistics of the distributions at the different levels of aggregation. The spatial patterns of the data could be approached by measurements of the similarity of the characteristics of the units of analysis and the proximity of the corresponding points or polygons. Spatial autocorrelation deserves special attention because our units of analysis are often contiguous and the points could artificially divide the same population, especially in the rural areas. The spatial autocorrelation, or spatial association, originates because the value of a variable in a unit of analysis is related to the neighboring units; therefore, as is well known, the "geographic units are tied together, like bunches of grapes" (Stephan, 1934; Unwin & Hepple, 1974), and closer units have more similar values (Fotheringham, Brunsdon, & Charlton, 2003). This is Tobler's First Law of Geography, which states that, "everything is related to everything else, but near things are more related than distant things" (Tobler, 1970, p. 236).

I will present two popular measures of spatial autocorrelation, Moran's I Index and the Local Indicator of Spatial Association (LISA) known as Local Moran or Anselin Local Moran's I. In both measures the autocorrelation is proportional, "to the weighted similarity of the point attribute values" (Wong & Lee, 2005, p. 261). The statistics can be calculated using points (as localities and ADPIs are represented) or polygons (as

MxHCGUs and ECs are represented).

For each variable we will include descriptive statistics for the aggregation levels of ECs, MxHCGUs, ADPIs, all aggregated areas of reference, and localities (distinguishing the whole set of data from the set excluding those with fewer than 250 people). We exclude the spatial statistics of the aggregated areas of reference created only to compare the ADPIs.

Moran's I

Moran's I index comes from this formula:

$$I = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij} s_{ij}}{\sigma^2 \sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}}$$

Equation 1: Moran's I

Where w_{ij} is the proximity weight for the relationship between points *i* and *j*, from the set of *n* cases included in the sample. The conceptual basis is the need to give more weight to the closer neighbors, since we expect them to have more similar values. The definition of the proximity weight could follow the binary form of 0 or 1, depending on points *i* and *j* being, or not being, considered as neighbors. Another way to assign the weight would be the inverse of the squared distance. For this research I use the inverse of the distance, which is also a common way to weight proximity:

$$w = \frac{1}{d_{ij}}$$

Equation 2: Moran's I weight

The similarity of attribute values (s_{ij}) for Moran's I is computed as the product of the differences from the mean value of the values of *i* and of *j*:

$$s_{ij} = (x_i - \bar{x})(x_j - \bar{x})$$

Equation 3: Moran's I similarity of attribute values

And the population variance (σ^2) is estimated as usual, assuming it equals the variance of the sample:

$$\sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$$

Equation 4: Moran's I σ2

Therefore, we can reorganize the formula to use only the observed values:

$$I = \frac{n \sum\sum w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum\sum w_{ij} \sum(x_i - \bar{x})^2}$$

Equation 5: Moran's I (observed values)

The calculated value will be compared to the expected value of Moran's I, which is:

$$E(I) = \frac{1}{n-1}$$

Equation 6: Moran's I expected value

As we see, for big samples, the expected value approaches zero. If the calculated value is greater than the expected value, we know that neighboring features (points or polygons) show similar characteristics; if the calculated value is smaller, it means that neighbors show different characteristics; similar values indicate a random pattern. Now the significance of the index can be evaluated using the *Z* distribution:

$$Z = \frac{I - E(I)}{\sqrt{VAR(I)}}$$

Equation 7: *Z* for evaluating Moran's I

The variance (VAR) is estimated differently for points and for polygons. In the

case of points, when we assume normality—meaning that the values are one set of values from an infinite possible set and each value is independent of the others in the set of attribute values—the variance can be calculated:

$$VAR(I)_{points} = \frac{(n^2 S_1 - nS_2 + 3W^2)}{W^2(n^2 - 1)} - [E(I)]^2$$

Equation 8: Variance for Moran's I for points

In this case, the variance depends heavily on the weights, since:

$$S_1 = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n}(w_{ij} + w_{ji})^2}{2}$$

Equation 9: S_1 for Moran's I

and:

$$S_2 = \sum_{i=1}^{n}(w_{i.} + w_{.j})^2$$

Equation 10: S_2 for Moran's I

Where the dot (.) denotes the sum of all other subscribed:

$$w_{i.} = \sum_{j} w_{ij}$$

Equation 11: $w_{i.}$ in Moran's I

W is also another aggregation of weights:

$$W = \sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}$$

Equation 12: *W* in Moran's I

In the case of polygons, and again assuming normality in the distribution of the values, the variance would be calculated:

$$VAR(I)_{polygons} = \frac{(n^2 S_1 - nS_2 + 3W^2)}{W^2(n^2 - 1)}$$

Equation 13: Variance for Moran's I for polygons

In this case the variance depends on the weights exactly as in the case of points. Therefore, S_1 is estimated as in Equation 9, S_2 as in Equation 10, and W as in Equation 12.

Local Indicator of Spatial Association (LISA)

Moran's I as global statistic measures the correlation in the whole area and for all the units of analysis, but the spatial autocorrelation is likely to vary across regions. Therefore, it would be useful to capture the variation in a Local Indicator of Spatial Association (LISA). The local Moran statistic for the space unit *i*, also known as the Anselin Local Moran's I (Anselin, 1995), is defined as:

$$I_i = z_i \sum_{j=1}^{n} w_{ij} z_j$$

Equation 14: LISA

We can observe that z_i and z_j are the z-score of x_i and x_j respectively. They are calculated as deviations from the mean:

$$z_{i.} = \frac{(x_i - \bar{x})}{std.dev.}$$

Equation 15: z_i for LISA

Here again, the calculated value will be compared to the expected value of LISA. If the calculated value is greater, it indicates that neighboring polygons show similar characteristics; if the calculated value is smaller, neighboring polygons show different characteristics; and similar values indicate a random pattern. The expected value is:

$$E(I_i) = \frac{-w_{i.}}{n-1}$$

Equation 16: Expected value for LISA

Where w_i. is defined as in Equation 11, considering that by convention w_{ii}=0. Again in this case, the expected value approaches to zero when the sample increases. The significance of each index can be evaluated—also in this case—using the *Z* distribution:

$$Z = \frac{I_i - E(I_i)}{\sqrt{VAR(I_i)}}$$

Equation 17: *Z* for evaluating LISA

The variance (VAR) is estimated assuming randomization, which implies that the values are distributed in one of many possible ways with the given set of values, but values are not necessarily independent. In such a case, the formal definition is:

$$VAR(I_i) = w_{i.}^{(2)} \frac{\left(n - \frac{m_4}{m_2^2}\right)}{(n-1)} + 2w_{i(kh)} \frac{\left(2\frac{m_4}{m_2^2} - n\right)}{(n-1)(n-2)} - \frac{w_{i.}^2}{(n-1)^2}$$

Equation 18: Variance for LISA

The variance, as in the former cases, also depends on the weights:

$$w_{i.}^2 = \left(\sum_{j=1}^{n} w_{ij}\right)^2$$

Equation 19: $w_{i.}^2$ for LISA

and:

$$w_{i.}^{(2)} = \sum_{j=1}^{n} w_{ij}^2, \quad i \neq j$$

Equation 20: $w_{i.}^{(2)}$ for LISA

And also:

$$2w_{i(kh)} = \sum_{k \neq i} \sum_{h \neq i} w_{ik}\, w_{ih} \ , \qquad k \neq h, j \neq i$$

Equation 21: $2w_{i(kh)}$ for LISA

But the variance for local Moran's I also depends on the standardized values:

$$m_2 = \frac{\sum_{i=1}^{n} z_i^2}{n}$$

Equation 22: Standardized values m_2 for LISA

and:

$$m_4 = \frac{\sum_{i=1}^{n} z_i^4}{n}$$

Equation 23: Standardized values m_4 for LISA

After the values of LISA are obtained, they could also be displayed on the map to observe areas with higher spatial correlation. In this research, we will use LISA for the data aggregated by ECs, MxHCGUs, and ADPIs. Once the features having significant local spatial autocorrelation are identified, I will report the total percentage of units of analysis with high values that are close to other units also having high values (the percentage of low values close to other low values will also be displayed as reference).

It is important to analyze the patterns of spatial autocorrelation for each dimension of poverty and for the index of all of them together. This will help us to understand the multidimensional dynamics of poverty and how it is distributed in the Mexican territory. The dependent variable is the most important to be checked for spatial autocorrelation, because the outcomes could be better explained by the influence of neighbors than by the variables included in the model. Since spatial correlation could violate the assumptions of the independence of the observations for modeling the data,

we will test for it again in the models, as will be explained later.

Modeling the Data

The models to be used depend on the characteristics of the data, particularly on the distribution of the variable we are modeling as the outcome. This section presents three different kinds of models to address the characteristics of the data: the basic way of modeling data at each level of aggregation (excluding the locality level as explained previously), the model used to test spatial autocorrelation of the most significant models, and the model to integrate together the level of ECs and the level of MxHCGUs.

It is important to add a note regarding the meaning of statistical significance when using data from censuses and national directories. We do not have a sample of cases, properly speaking, because both data sources have the goal of gathering all the available data about the total population. With data on the whole population, regression analysis could be understood as a tool for having simultaneous controls in order to evaluate a relationship, ignoring probability issues. But we should note that even the decision in terms of the time period of a cross-sectional analysis involves certain randomness. Moreover, the statistical significance addresses other problems than the sampling error. There is always uncertainty underlying the distribution of the data and, therefore, there is a distribution of the point estimates around the population parameter. We need to establish a plausible and credible interval in order to obtain a reliable interpretation of reality, taking into account the fuzziness of social phenomena.

Negative Binomial Models

The distribution of the number of parishes at the different levels of aggregation, as detailed in the following chapters, broadly corresponds to the Poisson distribution. Therefore, the main assumptions are that we observe events that can be represented by

their rate of incidence: in this case the event is the presence of every parish in the corresponding unit of observation. The population size of the unit of observation is the exposure, so the incidence rate multiplied by the exposure will give us the number of events (or the expected number in the case of the model). When we have lower exposure, there is small probability of finding more than one event. We consider exposures as independent when they do not overlap (StataCorp., 2009b, p. 1365 ss), but we have already discussed the potential violation of independence due to geographic contiguity—spatial autocorrelation, and we will detail a strategy to deal with this problem.

We expect that a Poisson distribution will be positively skewed, having a mean equal to its variance. Nevertheless, it will also be observed at all levels of aggregation that the mean number of parishes is smaller than the variance; therefore, that data are over-dispersed, as shown in Figure 6.

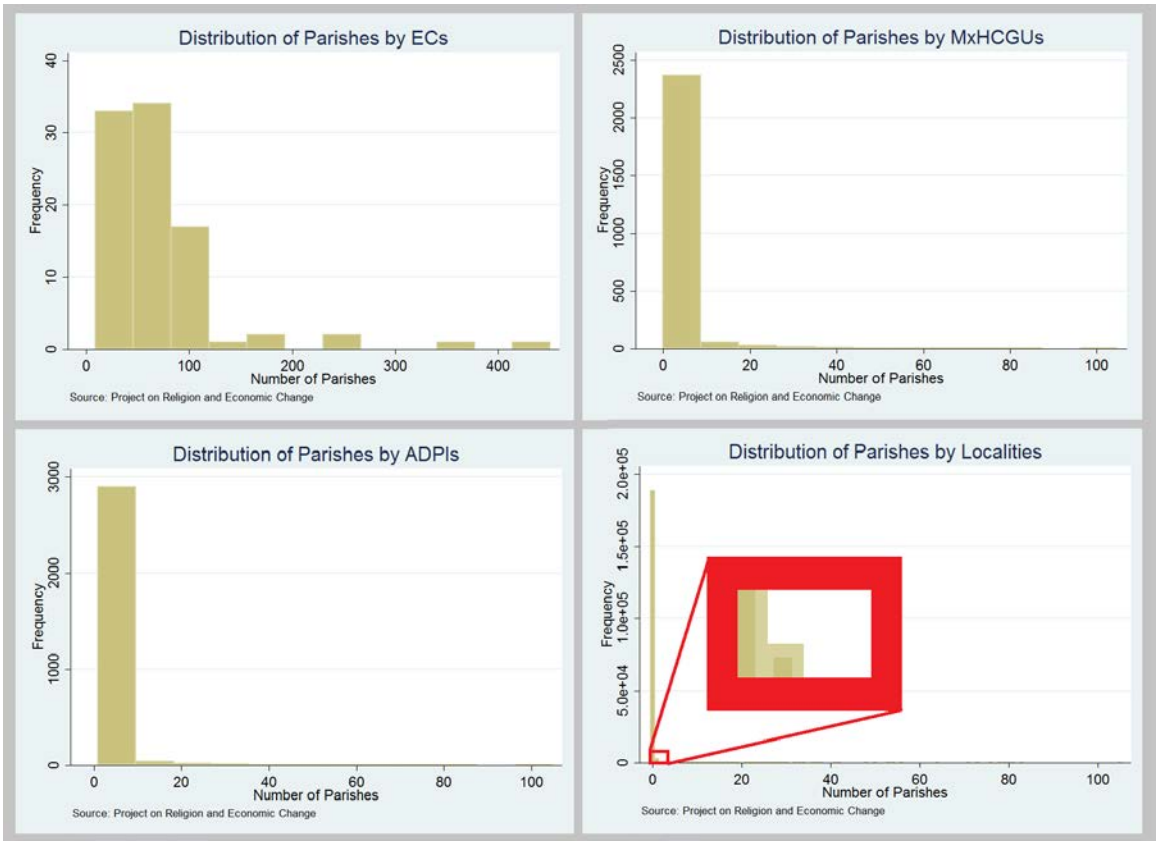

Figure 6: Distribution of Parishes at Different Levels of Aggregation.

Although we will not model the locality level, we add it here in order to compare all levels. We note that besides the over-dispersion, the locality level has a huge number of zeros but we cannot identify a factor for the zero-inflation besides the aggregation itself.

Therefore, the negative binomial regression seems to be the most appropriate way of modeling the data we are dealing with at the different levels. As well as the Poisson regression, a negative binomial regression models the count of event occurrences, assuming that the event is over-dispersed, which means that there is extra variation. The Poisson regression in this case has an exposure corresponding to the total population (P) of the unit of analysis, and can be formally defined as:

$$\log(Y_i) = \log(P_i) + X_i\beta + v_i$$

Equation 24: Negative Binomial regression

Mixing the Poisson assumptions for the event counts with a proper distribution for random error, accounts for the over-dispersion, where a convenient distribution for the error term is the gamma, given by

$$e^{v_i} \sim \text{Gamma}(1/\alpha, \alpha)$$

Equation 25: Error for NB models

In this case, α is the over-dispersion parameter. A Poisson model assumes a value of α=0. When there is over-dispersion, the value of α parameterizes it: thus, the value of α gets bigger as the dispersion grows.

We note that when the null hypothesis of spatial independence is rejected by the test for spatial autocorrelation of the model and the coefficients, we will include as a predictor the average number of parishes in neighboring units. This will be detailed in the following section.

Geographically Weighted Regressions

Most regression procedures assume "that the relationship we are modeling holds everywhere in the study area—that is, the regression parameters are 'whole-map' statistics" (Fotheringham, Charlton, & Brunsdon, 2003). Say that our units of observation are ADPIs *i*, then the usual fixed effects for a negative binomial model would be as Equation 24. In such a case, the parameters are constant for every unit across the whole area and the error term is distributed randomly. But when the units of observation are contiguous geographical areas, this assumption is usually violated, and when we display the residuals on a map, we can appreciate that the error has a geographical distribution

pattern. If we identify the coordinates of the geographical cases (u,v), we could re-elaborate the model as:

$$\log(Y_{i\,u,v}) = \log(P_{i\,u,v}) + X_{i\,u,v}\beta + v_{i\,u,v}$$

Equation 26: GW Negative Binomial model

This "individual level behavior for aggregate data" is called ecological inference (EI). Extreme spatial heterogeneity and spatial autocorrelation are two problems resulting from IE. Spatial heterogeneity, or non-stationarity, means that the model is characterized by variations in the parameters and that the error term across spatial observations is not constant due to the spatial autocorrelation (Fotheringham, Brunsdon, et al., 2003).

We can use a Geographically Weighted Negative Binomial Regression (GWNBR). Geographically Weighted Poisson Regression (GWPR) has been used in a similar way in other studies of contiguous units of observation (Calvo & Escolar, 2003; O'Loughlin, 2003). Geographically Weighted Regression (GWR) "is based on the assumption that data are weighted according to their proximity to point i[jk] and the weights are not constant but vary with proximity to point i[jk]" (O'Loughlin, 2003). If spatial correlation is present, the parameters can be mapped to see their geographic pattern. The procedure estimates "the parameters at the location (u,v) and a predicted value … through the implementation of the geographical weighting scheme" (Fotheringham, Charlton, et al., 2003). This means that closer data have a heavier weight in the model for each point u,v. The statistical procedure examines the significance of spatial variation by estimating a threshold for significant neighbors and conducting a Monte Carlo simulation. GWR tests the adequacy of the null hypothesis for the global model against the alternative of GWR. The procedure also tests if each one of the parameters has significant spatial variation. Both hypotheses are tested by Monte Carlo

simulation (Charlton, Fotheringham, & Brunsdon, 2006; Fotheringham, Brunsdon, et al., 2003; Pearce, 1998).

When the null hypothesis of spatial independence is rejected, the calculated threshold (or any other theoretically adequate distance) will be used to identify the influential "neighbors," and then include the average value of the outcome for those neighbors as another variable in the model in order to account for spatial dependence (Getis & Aldstadt, 2004; Sun Sheng Han & Bo Qin, 2009). The weighted average of neighbors orthogonalizes the regression.

Although the initial research proposal expected that when including the important variables in the model spatial autocorrelation would not be significant, we ended up rejecting the null of no spatial variation in most cases, as will be shown later on. In other words, pastoral services, net of the selected socio-demographic conditions, could depend on spatial context.

Hierarchical Linear Models

Because the Catholic Church is hierarchical by definition (C.I.C., c. 129-139), any research about its organizational dimension encompasses hierarchical data. We have already presented the different levels of aggregation for this research. ECs always include territorial subunits as parishes; however parish historical data are not usually available. We have also mentioned that historical population is the only available variable for localities. Most historical data are usually presented using the municipality level for socio-demographic variables (which will be subdivided into MxHCGUs) and the ECs level for pastoral data. Therefore, the most common hierarchical structure of our data mixes the civil and the ecclesiastical boundaries (as graphically represented in Figure 7).

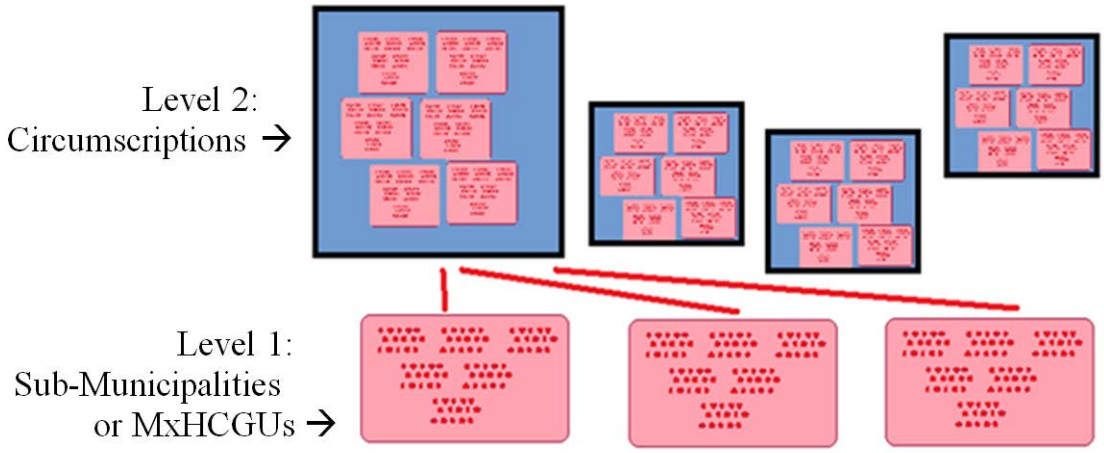

Figure 7: Hierarchical Structure of the Data.

This hierarchical structure implies that municipalities are in the territory of a circumscription. This is the reason for using hierarchical linear models (HLM) in order to explain the indicators of pastoral service using socio-demographic predictors.

Say that our units of observation are MxHCGUs *i*, situated in the set of ECs *j*, the usual fixed effects for a negative binomial model would be:

$$\log(Y_{ij}) = \log(P_{ij}) + X_{ij}\beta + v_{ij}$$

Equation 27: NB model, FE

This model could be an interesting starting point, but the historical data available require a slightly different equation. The data on pastoral services are presented by ECs and there is no way to distribute them among the MxHCGUs. Therefore we can aggregate all the data at the level of ECs (and use the model presented in Equation 24 at the level of ECs). Nevertheless, if we have more detailed socio-demographic data, we can take into account the variation in the predictors, by using HLM. In this case we would have predictors aggregated by MxHCGUs and the counts for parishes as well as the exposure aggregated by ECs. If instead of fixed effects we model random intercepts, we

would have the following model:

Level 1:

$$\log\left(Y_{[i]j}\right) = \log\left(P_{[i]j}\right) + \beta_0 + X_p\beta_{p\,ij} + X_c\beta_{d\,ij} + v_{ij}$$

Level 2:

$$\beta_0 = \gamma_{00} + u_{0j}$$

Equation 28: NB HLM, random intercept

This equation assumes a negative binomial distribution for *Y*, the number of parishes by each EC *j*, and includes the natural logarithm of the population of the EC *j* as an offset to the model to account for exposure. We don't know the variation of the number of parishes by MxHCGUs *i*, thus we assign the same value of the EC *j* for each of the MXHCGUs *ij* included in its territory. Although we have the population in detail, we also use as exposure the population of the EC *j* to get the observed rate. The set of main predictors, that is the dimensions of poverty or the poverty index, are represented by $X_{p\,ij}$, whereas the control variables are represented by $X_{c\,ij}$. They both vary by MxHCGUs *ij*. There is an error term at the level of the MxHCGUs *ij* which varies across them. We notice in Level 2 that the intercept is specified to vary for each of the ECs *j*.

As mentioned previously, the error v_{ij} has a gamma distribution given by Equation 25. Nevertheless, a closer focus on the error reveals that we are calculating the degrees of freedom corresponding to the total number of MxHCGUs. Since the model includes the total number of MxHCGUs, this approach will artificially diminish the standard error and inflate the model coefficient *z* values. However, we have outcomes only at the level of the ECs. To deal with this challenging underestimation of the error, we can weigh the models using the proportion of the total population of the EC corresponding to each MxHCGU. That way, we will be using weighted degrees of freedom at the MxHCGUs level corresponding to the degrees of freedom at the level of ECs (91 observations). The

weighted regression (StataCorp., 2009c, p. 305 ss) will have an error v_{ij}, with a weighted variance *wVAR*:

$$wVAR = VAR \times \frac{1}{\sqrt[2]{\sum \frac{w_{ijk}}{n}}}$$

Equation 29: Weighted *VAR* for NB model

Since we know that the variance comes from the difference between the expected and the observed values, we can reformulate the weight as:

$$wVAR = \frac{\sum \widehat{log(Y_{ij})} - \sum log(Y_{ij})}{\sqrt[2]{n} \times \sqrt[2]{\sum \frac{w_{ij}}{n}}} = \frac{\sum \widehat{log(Y_{ij})} - \sum log(Y_{ij})}{\sqrt[2]{\sum w_{ij}}} = \frac{\sum \widehat{log(y_j)} - \sum log(y_j)}{\sqrt[2]{j}}$$

Equation 30: Weighted *VAR* in terms of *n*

And:

$$w_{ij} = \frac{TPOP_{ij}}{TPOP_j} \; ; \; \sum j = \sum w_{ij}$$

Equation 31: Weight for NB model

Notice how the weight corresponds to the quotient of dividing the total population of the MxHCGU by the total population of the EC. Since analytic weights cannot be introduced in the estimation algorithm, we manually weight the standard error using:

$$wSE_\beta = \frac{\sqrt{TPOP_{ij}}}{\sqrt{TPOP_j}} \times SE_\beta$$

Equation 32: Weighted *SE* of β

Considering that we have 2,490 MxHCGUs but outcomes corresponding to 91 ECs (91 degrees of freedom), the weight for the standard errors of the coefficient would correspond, in practical terms, to:

$$wSE_{\beta} = \frac{\sqrt{2{,}490}}{\sqrt{91}} SE_{\beta} = \frac{49.9}{9.5} SE_{\beta} = 5.2\ SE_{\beta}$$

Equation 33: Weight for the *SE* of β

Therefore, when adjusting for the degrees of freedom, the standard errors of the coefficients should be multiplied by 5.2 (rounded for display). This way, we end up with the weighted degrees of freedom of 91, which is the number of observations at the circumscription level. This corrects the overestimation of statistical significance and leads to more conservative statistical tests.

HLM is also useful to evaluate how different levels of aggregation could work together. Since the results at different levels of aggregation could show different results, because of the already presented Modifiable Areal Unit Problem or MAUP (Dark & Bram, 2007; Stephan, 1934; Unwin & Hepple, 1974), these results can also be compared to the models at the MxHCGUs and ECs levels.

Prospective Use of the Research Design

Time and effort invested in data processing and modeling make complete sense as part of the Project on Religion and Economic Change (PREC). In the broader project, I seek to understand the relationship between religious service provision and life conditions in Mexico. This relationship is complex because services provided by religious groups may influence people's life conditions, but at the same time the economic and political resources communities have may influence where religious groups provide resources. Without longitudinal data we cannot test which of these mechanisms is operating or if both are operating at the same time. As part of this broader project, we are gathering data from the end of the 19th century to the present using both governmental and religious sources (including printed sources, manuscripts and archival

data available in Mexico and Rome). These data will allow the measurement of both life conditions and services provided by religious groups for more than a century and test their mutual influences. This will make it possible to better understand possible flows of causality. The study presented here is limited to analyze cross-sectional correlations, but it is a necessary first step. Once longitudinal data are integrated, we will be able to test if the Catholic Church, as an institution, has eventually shown a preferential option for the poor, if that has been shaped from the narrative of the bishops congregated in Medellin, or if the organization has been prioritizing a commitment for religious competition, trying to keep the higher proportion of affiliation. We will also be able to test if pastoral work has made any difference in the life quality of the population. The research I propose here advances the configuration of the data and the evaluation of some methods to model them.

Chapter 5: Distribution of Multidimensional Poverty in Mexico

This section will present the distribution of our measurements of poverty at different levels of aggregation. This will be done by describing the five dimensions of poverty to be considered for this research: the deprivation of material goods, the unavailability of running water, the limited right to access health services, the inability to read and write, and the condition of being indigenous. The distribution of the index of multidimensional poverty that aggregates the five dimensions will be presented as well.

5.1. Deprivation of Material Goods

We use the percentage of households lacking material goods as a proxy of poverty in terms of economic resources. We assume that when a household lacks economic resources, it will not have a car, washing machine, refrigerator, phone, cell phone, internet access, personal computer, television, or radio. This refers to the most common understanding of poverty in the tradition of economics. We observe in Table 1 that there is not an even distribution of this variable at the different levels of aggregation:

	All Localitites n = 191935	Localities over 250 inh. n = 32397	ADPIs n = 2997	MxHCGUs n = 2490	ECs n = 91
Moran's Index:	0.410383	0.498019	0.275149	0.330012	0.132997
Expected Index:	-0.000005	-0.000031	-0.000330	-0.000402	-0.011111
p-value:	0	0	0	0	0.000008
Distance Threshold:	30.3 km	85.9 km	137.8 km	230.0 km	373.0 km
Percentage of high values close to other high values:			13.40%	19.96%	8.79%
Percentage of low values close to other low values:			19.27%	35.18%	-

Table 1: Autocorrelation of the Percentage of Households Deprived of Material Goods.

When all the localities are taken into account, Moran's Index equals 0.41,

whereas when only localities having more than 250 inhabitants are considered, the index is 0.50. In Areas of Direct Pastoral Influence (ADPIs), which are the aggregation of localities close to parishes, the index is 0.28, which differs clearly from the smaller levels of aggregation. The index corresponding to the Maximum Historically Consistent Geographic Units (MxHCGUs) is 0.33, and the value when we measure spatial autocorrelation aggregating data by the 91 Ecclesiastical Circumscriptions (ECs) is 0.13.

The values are not directly comparable among them because the thresholds are different, but in every case there is a positive spatial autocorrelation and it is statistically significant. When considering the values for each unit of analysis using the local Moran's I, we find that 13% of the ADPIs are areas with a high percentage of deprivation of material goods and close to other places with high values as well. This is the situation for 19% of the MxHCGUs and for 8% of the ECs. Therefore, we can see that the two lowest levels of aggregation (by localities) correspond to the higher spatial correlation in terms of Moran's I. The lowest spatial correlation of percentages of households deprived of material goods is at the level of ECs, both in general terms and regarding higher values.

A closer look at the percentages at the different levels shows that measurements of central tendency have differences among the different levels of aggregation as well (Table 2):

	All Localitites n = 191935	Localities over 250 inh. n = 32397	Aggregated Areas n = 24940	ADPIs n = 2997	MxHCGUs n = 2490	Ecclesiastical Circumscriptions n = 91
Mean	13.53	9.13	10.36	4.69	8.5	4.87
Standard Deviation	18.32	12.84	13.59	7.06	10.35	7.21
Minimum value	0	0	0	0	0	0.2
Median	6.34	4.17	5.06	2.21	4.37	2.07
Maximum value	100	100	99.01	66.74	79.6	38.61
Percentage of zeroes	22.98%	7.70%	0.38%	0.01%	0.36%	-

Table 2: Distribution of the Percentage of Households Deprived of Material Goods.

We can observe that all the levels show a positively skewed distribution because the medians are always smaller than the means. This will be a shared characteristic in all the measurements of poverty we will be presenting. In this case the means are about twice as big as the medians. The two lowest levels of aggregation have the larger range for the data and the highest number of zeros. All levels show over-dispersion but the number of zeros does not favor any detailed modeling at these two particular levels.

The two levels of aggregation coming from units of analysis properly corresponding to the provision of pastoral services have very similar values. The mean for ADPIs is 4.7 and the median is 2.2, whereas for ECs the mean is 4.9 and the median 2.1. Those levels of aggregation show the smallest standard deviation, which is 7.0 and 7.2 respectively. The median values for ECs and ADPIs are smaller than other medians. This indicates that neither of these aggregations has many cases in higher values of poverty.

In the map of Figure 8, we observe that many localities with the highest number of households with limited material goods (top 1%) fall inside the areas of the

MxHCGUs with the highest percentage of this dimension of poverty, although there are localities outside of such municipalities.

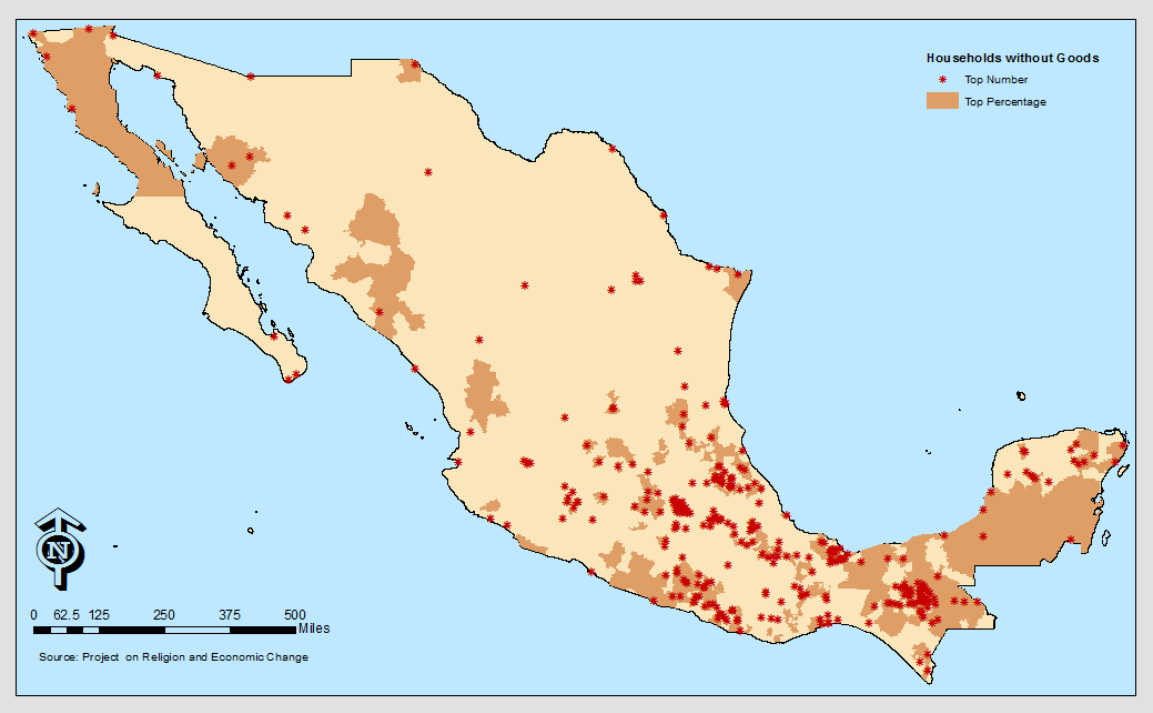

Figure 8: Map of Top Areas of Deprivation of Material Goods.

Because we find different patterns of geographical dispersion of the variable when it is measured in different ways and different units of aggregation, we will not have many consistent areas of this dimension of poverty.

5.2. UNAVAILABILITY OF RUNNING WATER

The percentage of households without running water is the selected proxy for measuring the deprivation of commodities. We can observe that the distribution of poverty in terms of not having access to running water is not even (Table 3):

	All Localitites n = 191935	Localities over 250 inh. n = 32397	ADPIs n = 2997	MxHCGUs n = 2490	ECs n = 91
Moran's Index:	0.343199	0.195377	0.174445	0.172935	0.154505
Expected Index:	-0.000005	-0.000031	-0.000330	-0.000402	-0.011111
p-value:	0	0	0	0	0.000001
Distance Threshold:	30.3 km	85.9 km	137.8 km	230.0 km	373.0 km
Percentage of high values close to other high values:			14.29%	19.76%	12.09%
Percentage of low values close to other low values:			19.47%	29.80%	-

Table 3: Autocorrelation of the Percentage of Households without Access to Running Water.

Moran's index looks smaller in general. For all the localities, it has a value of 0.34, but when excluding smaller localities, we obtain an index of 0.20. Although values are not directly comparable, we can interpret the difference as meaning that this variable is much more spatially correlated when smallest municipalities are included because it is more difficult to provide the advantages of urbanization to places with few people far from urban areas but close to each other. Moran's I for ADPIs and for MxHCGUs rounds to 0.17, and to 0.15 when corresponding to ECs. All indexes are statistically significant.

The local Moran's I index shows a pretty similar proportion of units of analysis of high value close to neighbors with high values as well: 14% of the ADPIs, 20% of the MxHCGUs, and 12% of the ECs are in this situation. We observe a lower percentage in units aggregated directly because of pastoral services provided there.

Table 4 shows the differences in the distributions of the percentages when aggregated in different ways:

	All Localitites n = 191935	Localities over 250 inh. n = 32397	Aggregated Areas n = 24940	ADPIs n = 2997	MxHCGUs n = 2490	Ecclesiastical Circumscriptions n = 91
Mean	54.64	27.42	29.85	15.6	20.19	16.03
Standard Deviation	36.24	34.16	33.38	19.3	20.09	14.76
Minimum value	0	0	0	0	0	1.98
Median	60	9.79	13.65	7.5	12.37	9.92
Maximum value	100	100	100	100	98.98	71.04
Percentage of zeroes	9.03%	6.20%	0.30%	-	0.28%	-

Table 4: Distribution of the Percentage of Households without Access to Running Water.

Besides all localities together, all other levels show a positively skewed distribution (medians smaller than means). The lowest level of aggregation is almost symmetrical and slightly left skewed, with a mean of 55 and a median of 60. Thus, at the locality level, half of the units of analysis have 60% or more households deprived of running water.

The number of zeros is considerably smaller than in the former dimension of poverty and we find that except for the level of ECs, all other levels have the complete range of values.

The highest average percentage of people without access to health services corresponds to the locality level (mean of 55%). All other levels have means between 16% and 30%. Data corresponding to the ADPIs have a mean and median smaller than when considering all other units of analysis, meaning that parishes seem to be located in less aggregated poor areas regarding this dimension. The values for the level of ADPIs and for the level of ECs are not as close as in the former variable, but they are still close.

The map shows some localities with the highest number of households without

running water (top 1%) located out of the areas of the MxHCGUs with the highest percentage of households with such deprivation (Figure 9):

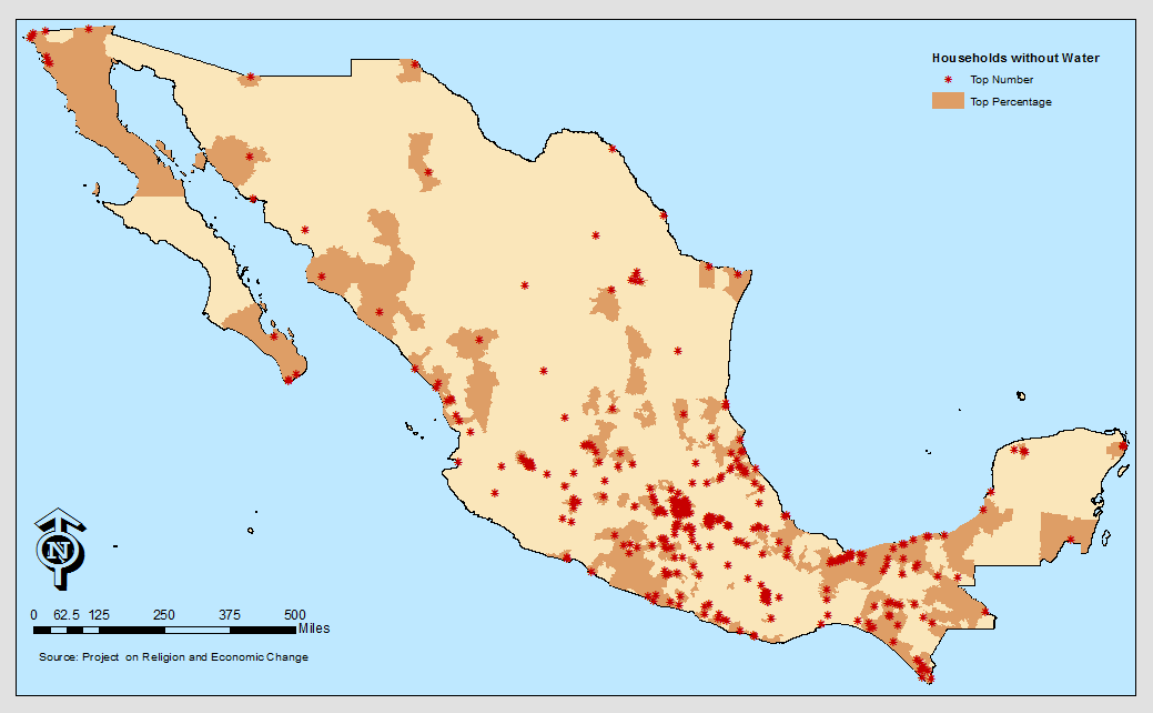

Figure 9: Map of Top Areas Having Households without Running Water.

Although we do not have highly consistent areas of this dimension of poverty in terms of the two levels of aggregation represented in the map, there is a clear zone of concentration of such dimension of poverty.

5.3. LACK OF RIGHT TO ACCESS HEALTH SERVICES

The percentage of the population without the right to access health services is used as a proxy for measuring the deprivation of health services and the vulnerability of health conditions. Some measurements of the spatial distribution of the variable can be observed in Table 5:

	All Localitites n = 191935	Localities over 250 inh. n = 32397	ADPIs n = 2997	MxHCGUs n = 2490	ECs n = 91
Moran's Index:	0.283981	0.183144	0.272221	0.198829	0.461196
Expected Index:	-0.000005	-0.000031	-0.000330	-0.000402	-0.011111
p-value:	0	0	0	0	0
Distance Threshold:	30.3 km	85.9 km	137.8 km	230.0 km	373.0 km
Percentage of high values close to other high values:			23.86%	26.59%	28.57%
Percentage of low values close to other low values:			20.92%	21.20%	12.09%

Table 5: Autocorrelation of the Percentage of People Deprived of Health Care Plan.

When we include all the localities in the analysis, we find that Moran's Index is 0.28, whereas when we consider only localities with more than 250 inhabitants, we get an index of 0.18. When focusing on the aggregation of only the localities close to parishes (ADPIs), the index is 0.27, which is a value pretty close to the one we get when including every locality. The index corresponding to the MxHCGUs is 0.20 and 0.46 is the value when we measure spatial autocorrelation aggregating data by ECs. In every case there is a positive spatial autocorrelation and it is statistically significant.

When considering the values for each unit of analysis using the local Moran's I we find that 24% of the ADPIs are areas with a high percentage of deprivation of health services and are close to other places with high values as well. This is the situation for 27% of the MxHCGUs and for 29% of the ECs. Therefore, we can see that the broader level of aggregation also corresponds to higher spatial correlation of the high percentages of people without the right of having health services. The measurement confirms the high value of Moran's I by EC.

If we consider the percentages at the different levels, we notice that the measurements of central tendency also have differences among the different levels of aggregation (Table 6):

	All Localitites n = 191935	Localities over 250 inh. n = 32397	Aggregated Areas n = 24940	ADPIs n = 2997	MxHCGUs n = 2490	Ecclesiastical Circumscriptions n = 91
Mean	42.54	36.64	36.62	37.01	37.9	34.06
Standard Deviation	23.87	22.09	21.66	16.83	17.42	9.93
Minimum value	0	0	0	1.03	1.28	14.44
Median	40	31.49	31.43	34.12	35.34	33.31
Maximum value	100	100	100	98.78	98.14	58.66
Percentage of zeroes	2.89%	0.38%	0.02%	-	-	-

Table 6: Distribution of the Percentage of People Deprived of Health Care Plan.

As usual, we can observe that all the levels show a positively skewed distribution because the medians are always smaller than the means. Nevertheless, the skewness is limited in this variable compared to the former measurements of poverty. At the highest level of aggregation, the difference between the median and the mean is the smallest and the distribution is pretty normal. The most detailed data at the locality level includes more zeros but the number is still relatively small.

The highest average percentage of people without access to health services corresponds to the locality level (mean of 43%). All other levels have means between 34% and 38%. The data corresponding to the ADPIs and ECs have means and medians smaller than when considering the MxHCGUs. Big localities and aggregated areas have pretty similar measurements.

In the map (Figure 10) we can observe that the localities with the highest number of people without the right to access health services (top 1%) roughly fall inside the areas of the MxHCGUs with the highest percentage of poor population in terms of the right to access health services.

Figure 10: Map of Top Areas of Deprivation of Health Care Access.

This situation means that we will have pretty consistent areas of this dimension of poverty and we can also conclude that some of the areas roughly correspond to places where we observe higher spatial autocorrelation.

5.4. INABILITY TO READ AND WRITE

The proxy for education marginalization is the percentage of the population of 15 years and older who cannot read and write. The spatial correlation of the distribution of those percentages, at different levels, is presented in Table 7:

	All Localitites n = 191935	Localities over 250 inh. n = 32397	ADPIs n = 2997	MxHCGUs n = 2490	ECs n = 91
Moran's Index:	0.485759	0.495122	0.353001	0.311907	0.213054
Expected Index:	-0.000005	-0.000031	-0.000330	-0.000402	-0.011111
p-value:	0	0	0	0	0
Distance Threshold:	30.3 km	85.9 km	137.8 km	230.0 km	373.0 km
Percentage of high values close to other high values:			19.97%	24.78%	13.19%
Percentage of low values close to other low values:			27.33%	31.20%	3.20%

Table 7: Autocorrelation of the Percentage of Illiterate Population.

Contrasting the former dimension, the biggest value for Moran's I (0.50) is found when we exclude only the smallest localities from the analysis, and we find a similar value when all the localities are included in the analysis (0.49). Moran's Index for ADPIs is 0.35, for MxHCGUs it is 0.31, and the smaller value of 0.21 corresponds to the level of ECs. As usual, there is always a statistically significant positive spatial autocorrelation.

Local Moran's I shows that 20% of the ADPIs are characterized by having high rates of illiteracy and being located close to other ADPIs with high values. 25% of the MxHCGUs and 13% of the ECs have similar characteristics. We observe that the broadest level of aggregation has the smaller spatial correlation of the high percentages of illiterate people, meaning that illiteracy is more likely to be found in small areas that are close to each other.

We can better understand the distribution of the percentages at the different levels by comparing the measurements of central tendency shown in Table 8:

	All Localitites n = 191935	Localities over 250 inh. n = 32397	Aggregated Areas n = 24940	ADPIs n = 2997	MxHCGUs n = 2490	Ecclesiastical Circumscriptions n = 91
Mean	18.18	15.55	16.64	11.24	13.97	9.26
Standard Deviation	13.99	10.87	10.8	8.05	9.62	7.38
Minimum value	0	0	0	0.51	0.56	1.9
Median	15	13.09	14.39	9.17	11.82	7.06
Maximum value	100	91.08	89.93	59.15	66.55	38.13
Percentage of zeroes	5.60%	0.35%	0.01%	-	-	-

Table 8: Distribution of the Percentage of Illiterate Population.

All levels show a positively skewed distribution, although the means are not too far from the medians. We have in this case smaller mean percentages than in the former two dimensions, but higher than the first. Data detailed at the locality level includes about 6% of zeros, which is not a big proportion. The highest average percentage of illiterate people corresponds to the locality level (mean of 18%). The aggregated areas and the big localities have very similar measurements with means rounded to 17% and 16%, and medians rounded to 14% and 13% respectively. The MxHCGUs show a mean of 14% and a median of 12%, whereas the ADPIs show a mean of 11% and a median of 9%. The smallest values are found at the ECs level, with a mean of 9% and a median of 7%.

Only the level of localities has the complete range from 0% to 100%, whereas the ECs have a range from 2% to 38%.

The map shows that localities with the highest number of illiterate people (top 1%) generally fall inside the MxHCGUs with the highest illiteracy rate (Figure 11).

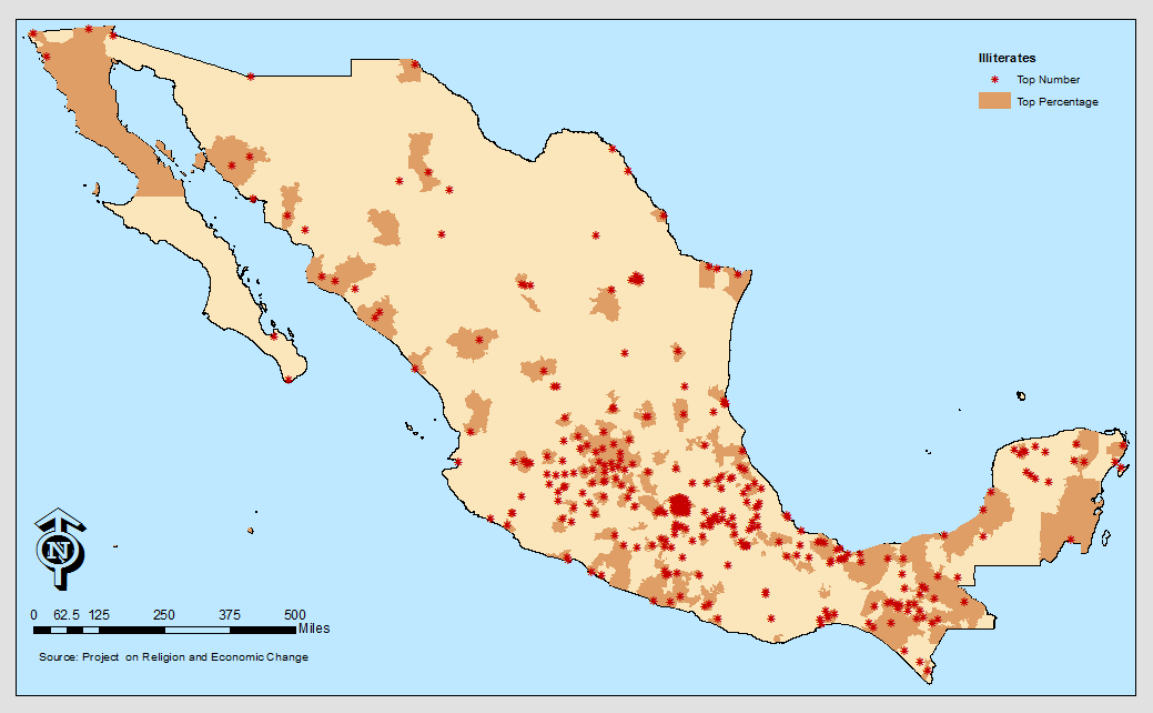

Figure 11: Map of Top Areas Having Illiterate Population.

This situation indicates, as in the case of the limited access to health services, pretty consistent areas of this dimension of poverty. We can also visually identify some places having positive spatial autocorrelation.

5.5. SPEAKING AN INDIGENOUS LANGUAGE

Indigenous marginalization is measured by the proxy of the percentage of the population aged 3 years and older who speak an indigenous language. Measurements of spatial autocorrelation for the levels of aggregation of the data are shown in Table 9:

	All Localitites n = 191935	Localities over 250 inh. n = 32397	ADPIs n = 2997	MxHCGUs n = 2490	ECs n = 91
Moran's Index:	0.805406	0.598371	0.257893	0.328068	0.147392
Expected Index:	-0.000005	-0.000031	-0.000330	-0.000402	-0.011111
p-value:	0	0	0	0	0.000001
Distance Threshold:	30.3 km	85.9 km	137.8 km	230.0 km	373.0 km
Percentage of high values close to other high values:			12.54%	21.69%	10.99%
Percentage of low values close to other low values:			8.75%	37.35%	-

Table 9: Autocorrelation of the Percentage of Indigenous Language Speakers.

Every single unit has a positive spatial autocorrelation which is also statistically significant. All the localities together have a Moran's I of 0.81. This is the highest value for this index compared to other dimensions of poverty. This makes sense because of the relative concentration of small localities in indigenous areas. Logically, the following highest value (0.60) corresponds to big localities. We also have indigenous municipalities, but the MxHCGUs show a Moran's I of only 0.33. Moran's I in terms of ECs equals 0.15, and 0.26 at the level of ADPIs. This means that the units of analysis configured by the offer of pastoral services do not usually have higher percentages of indigenous population in neighboring areas compared to other levels of aggregation.

Local Moran's I values show that 22% of the MxHCGUs are units with a higher percentage of indigenous people close to neighbors also having higher percentages. This happens for only 13% of the ADPIs and 11% of the ECs. Therefore, we can see that levels of aggregation made from the provision of pastoral care show lower percentages of indigenous people.

The percentages, at the different levels, are distributed as shown in Table 10:

	All Localitites n = 191935	Localities over 250 inh. n = 32397	Aggregated Areas n = 24940	ADPIs n = 2997	MxHCGUs n = 2490	Ecclesiastical Circumscriptions n = 91
Mean	14.21	17.88	19.1	10.13	18.96	10.6
Standard Deviation	28.88	33.33	34.04	23.42	30.75	19.12
Minimum value	0	0	0	0	0	0.17
Median	0.75	0.55	0.58	0.55	1.44	1.76
Maximum value	100	100	100	99.64	99.77	92.08
Percentage of zeroes	38.47%	24.19%	2.20%	0.05%	1.41%	-

Table 10: Distribution of the Percentage of Indigenous Language Speakers.

We have a dimension of poverty that is spatially concentrated in specific areas. All the levels show the most positively skewed distribution among the dimensions of poverty. The means are low, although the percentages of households without material goods and some aggregations of illiteracy rates have lower means. Nevertheless, the medians are much smaller than any other median values. The variable shows the most abundant number of zeros compared to any other dimension, although the range is almost complete at every level, meaning that every level of aggregation has some units with only—or mostly—an indigenous population. The highest average percentage of indigenous people is at the level of the aggregated areas of reference and when describing the MxHCGUs, both rounded to 19%—medians of 0.6% and 1.4% respectively. Big localities have a mean of 18% and all localities a mean of 14%, but their medians are of 0.6% and 0.8% respectively. All medians are from 0.55 to 1.76, which means that in any unit of aggregation, half of the units have a percentage lower than 2%. Lowest means correspond to data aggregated by ADPIs (10%) and ECs (11%).

The map shows that localities where the highest number of indigenous people lives (top 1%) are roughly located in MxHCGUs with the highest percentage of

indigenous people (Figure 12):

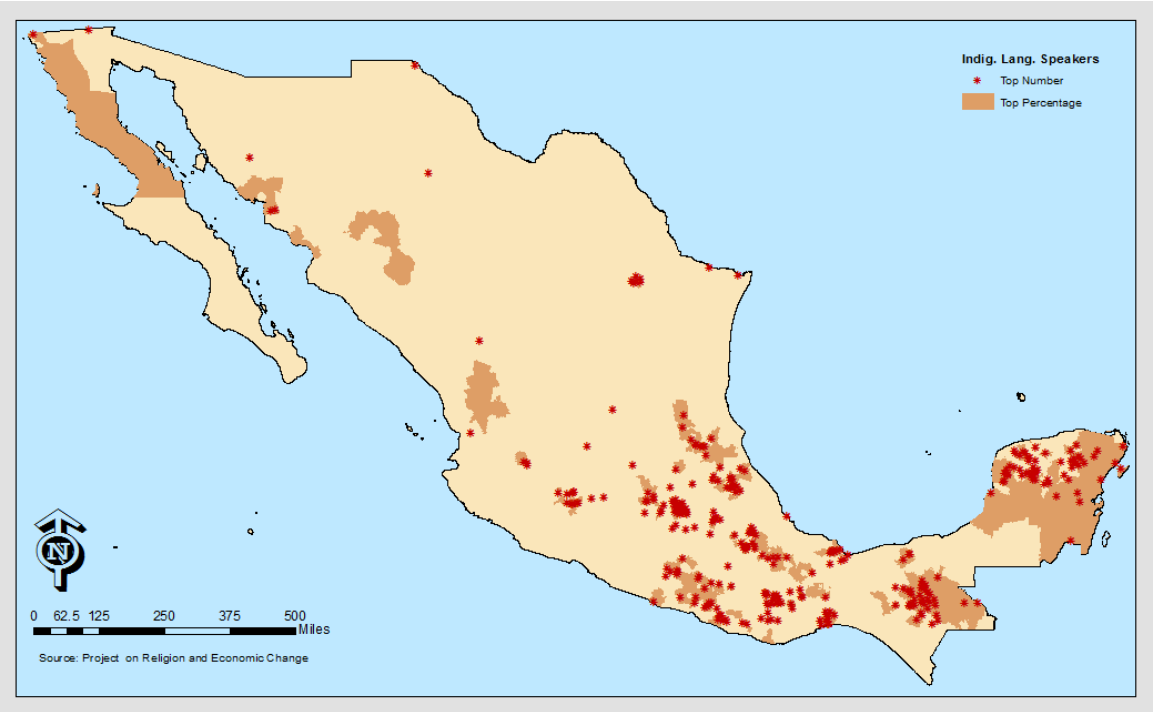

Figure 12: Map of Top Areas of Indigenous Population.

Indigenous areas tend to be consistent at the two levels of aggregation represented in the map because such areas correspond to places where indigenous groups have been settling for many years. Therefore, this variable has a historical reason for its higher spatial autocorrelation.

5.6. AGGREGATED INDEX OF POVERTY

The research design explains the strategy for aggregating data in order to assemble the index of multidimensional poverty. Table 11 shows the spatial autocorrelation of such measurement at the different levels of geographic aggregation of the data:

	All Localitites n = 191935	Localities over 250 inh. n = 32397	ADPIs n = 2997	MxHCGUs n = 2490	ECs n = 91
Moran's Index:	0.549158	0.495302	0.286027	0.360508	0.188732
Expected Index:	-0.000005	-0.000031	-0.000330	-0.000402	-0.011111
p-value:	0	0	0	0	0
Distance Threshold:	30.3 km	85.9 km	137.8 km	230.0 km	373.0 km
Percentage of high values close to other high values:			17.66%	24.18%	13.19%
Percentage of low values close to other low values:			25.68%	34.46%	3.30%

Table 11: Autocorrelation of the Aggregated Index of Poverty.

The index of poverty shows bigger autocorrelation (0.55) compared to other aggregations of the same variable and also compared to the individual dimensions of poverty (except for ethnicity). Bigger localities show a value of 0.50 and MxHCGUs a value of 0.36. Lower estimations of spatial correlation appear for the ADPIs (0.29) and for ECs (0.19). We can observe that all values are statistically significant and positive.

According to the result of the local Moran's I, 24% of the MxHCGUs are areas with a high value on the index neighboring places also sharing high values. This happens for 18% of the ADPIs and 13% of the ECs. The levels of aggregation defined by the provision of pastoral care, as was the case in some dimensions, show lower autocorrelation and lower geographic concentration of higher values.

The distribution of the index at different levels can be appreciated in Table 12:

	All Localitites n = 191935	Localities over 250 inh. n = 32397	Aggregated Areas n = 24940	ADPIs n = 2997	MxHCGUs n = 2490	Ecclesiastical Circumscriptions n = 91
Mean	28.62	21.32	22.52	15.73	19.91	14.96
Standard Deviation	15.58	14.99	15.16	10.61	12.71	10.1
Minimum value	0	0.2	0.31	2.11	2.16	4.5
Median	26.68	16.22	17.86	12.66	15.9	11.79
Maximum value	100	95.63	91.72	76.99	75.33	55.13
Percentage of zeroes	0.27%	-	-	-	-	-

Table 12: Distribution of the Aggregated Index of Poverty.

The index could have a range from 0 to 100, but since it averages the other five measurements, we can see that, as expected, in most levels the range is smaller. We see here medians smaller than the mean, but the differences are not as big as in some dimensions of poverty; therefore, the aggregation helps to control the skewness. We can also appreciate a limited number of zeros and it is only at the level of all localities.

The highest mean for the poverty index (29) is found at the locality level; and the distribution is pretty normal because the median at this level is 27. Bigger localities and aggregated areas also have high values for means (rounded to 22 and 23, respectively), and medians (16 and 18 respectively). The mean value for the MxHCGUs is 20 and the median is 16. As in other cases, lowest values correspond to the ADPIs (mean of 16, median of 13) and the ECs (mean of 15, median of 12). Therefore, the units configured from the provision of pastoral services have less concentration of poverty than other units of analysis.

In the map (Figure 13) we observe that top values seem to be more geographically concentrated. Localities cannot display number of people, but only the top 1% values of the index. Therefore, it is expected that such localities usually are inside the areas of the

MxHCGUs with the highest values of the index at their level, since consistency is also an effect of the level of geographical aggregation of the values:

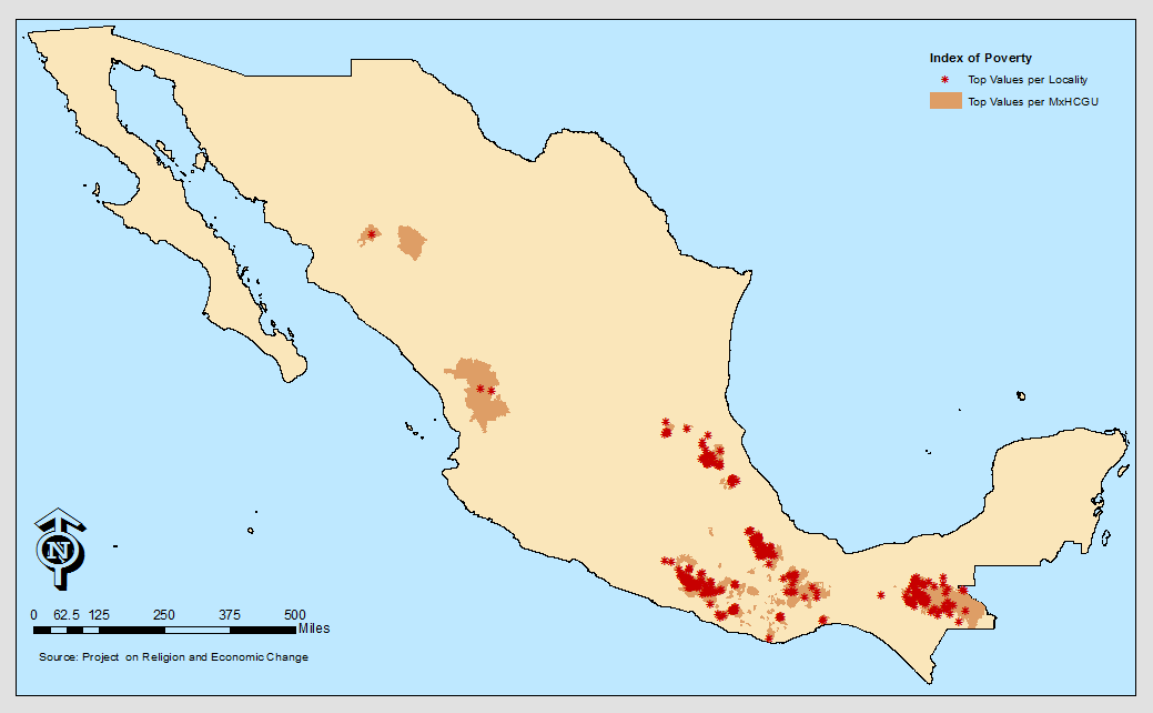

Figure 13: Map of Top Areas of the Aggregated Index of Poverty.

After analyzing the characteristics of the different measurements used to operationalize poverty and some of its dimensions, we can now present the description of the outcome we want to predict and to test the relation hypothesized in the research design.

Chapter 6: Distribution of Pastoral Services and their Correlation to Multidimensional Poverty in Mexico

This chapter will first describe the distribution of pastoral services in Mexico and will model the correlation between pastoral service, on the one hand, and the five dimensions of poverty and the aggregated poverty index, on the other hand. A panoramic perspective of the structure and division of Ecclesiastical Circumscriptions (ECs) will provide the general context for approaching the distribution of parishes all over the country. After identifying the main characteristics of the count of parishes, we can include it as the dependent variable in the models used to test the null hypothesis of null or negative correlation between the measurement of pastoral care and the different measurements of poverty.

6.1. DISTRIBUTION OF PASTORAL SERVICES IN MEXICO

We already said that the EC is the basic unit of the Catholic Church. In Mexico, ECs have been recently restructured into 18 Ecclesiastical Provinces, each one of them organized around one archdiocese. As I commented before, each bishop remains independent in his authority over his own circumscription, but the provinces could work as official bodies for sharing ideas and strategies of pastoral work. On December 31st of 2009 there were 18 archdioceses, 68 dioceses, and 5 prelatures. We are considering 6,623 parishes in the whole country, distributed in all the 91 ECs (see Appendix A for details). The map shows the concentration of parishes by circumscription (Figure 14):

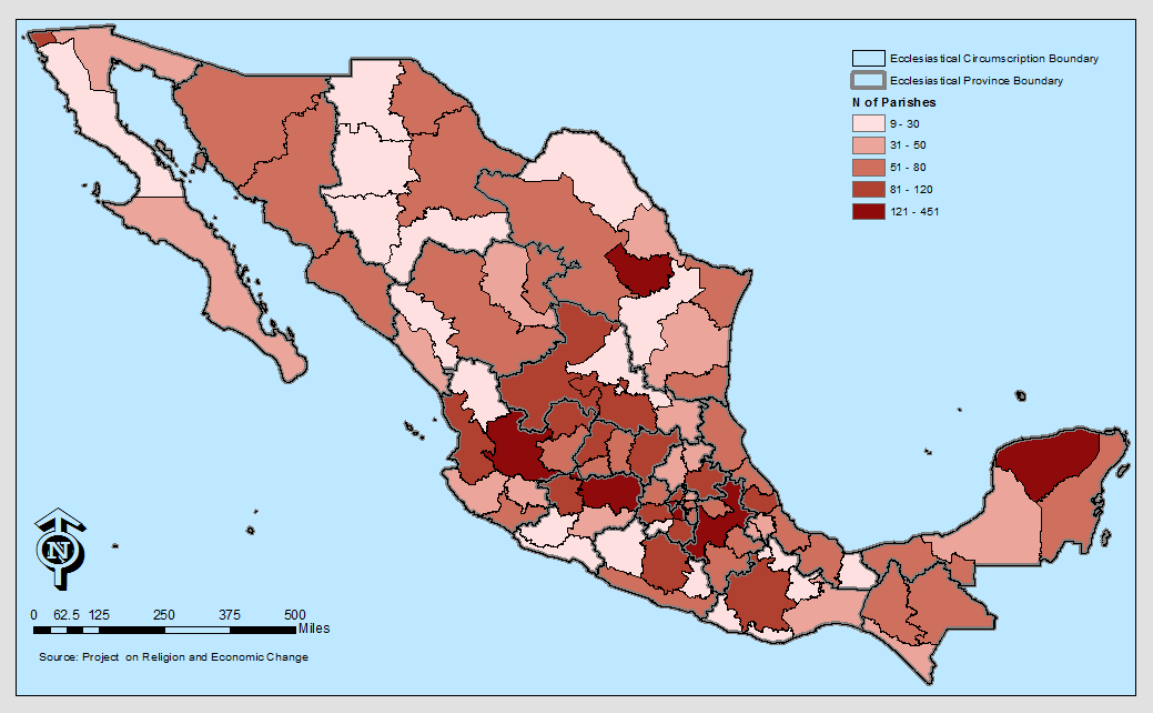

Figure 14: Map of Ranked Number of Parishes by ECs

The distribution of the number of parishes at the different geographic levels of aggregation of the data is shown in Table 13:

	All Localitites n = 191935	Localities over 250 inh. n = 32397	Aggregated Areas n = 24940	ADPIs n = 2997	MxHCGUs n = 2490	Ecclesiastical Circumscriptions n = 91
Mean	0.03	0.2	0.26	2.2	2.66	72.78
Standard Deviation	0.84	2.05	2.33	6.4	7.36	66.52
Minimum value	0	0	0	1	0	9
Median	0	0	0	1	1	58
Maximum value	105	105	105	105	105	451
Percentage of zeroes	98.42%	90.90%	87.98%	-	24.62%	-

Table 13: Distribution of the Number of Parishes.

The number of parishes follows an over-dispersed Poisson distribution. For all the levels of aggregation of the data, we have counts with the median smaller than the mean but variance larger than the mean. We also notice that the over-dispersion is less at the maximum level (the ECs). The mean number of parishes by EC rounds to 72 with a median of 58. The circumscription with fewer parishes is the Prelature of Huautla, with 9, whereas the Archdiocese Primate of Mexico has 451 parishes. When we consider the Areas of Direct Pastoral Influence (ADPIs), the mean is about 2, but we actually have 2,550 areas around one parish (85%) whereas only the top 1% have more than 30 parishes in the area, including the city of Guadalajara with 105 parishes.

When aggregating the data in any other way, we observe, of course, a large number of zeros. The mean number of parishes in the Maximum Historically Consistent Units (MxHCGUs) is 2.7, not very different from the mean by ADPIs. However, there are 1,047 MxHCGUs with only one parish and 613 without any parish at all—corresponding to 606 municipalities and 7 sub-municipalities. The other three levels of aggregation of the data have a median of 0 parishes. When considering all localities, the mean number of parishes is 0.03, because 188,905 localities included in the dataset do not have any parish (98%). If we limit our analysis to the bigger localities, we still find that there is no parish in 29,448 localities (91%), and the mean number of parishes is 0.2. The mean number of parishes for the aggregated areas of reference is 0.3 because the 21,943 (88%) areas added to the ADPIs in order to be compared are not defined around a parish.

The spatial correlation of the number of parishes at the different geographic levels of aggregation of the data can be observed in Table 14:

	All Localitites n = 191935	Localities over 250 inh. n = 32397	ADPIs n = 2997	MxHCGUs n = 2490	ECs n = 91
Moran's Index:	0.009247	0.015176	0.103092	0.100954	0.095455
Expected Index:	-0.000005	-0.000031	-0.000330	-0.000402	-0.011111
p-value:	0	0	0	0	0.000712
Distance Threshold:	30.3 km	85.9 km	137.8 km	230.0 km	373.0 km
Percentage of high values close to other high values:			2.34%	4.70%	4.40%
Percentage of low values close to other low values:			-	5.58%	-

Table 14: Autocorrelation of the Number of Parishes.

We find that the number of parishes has smaller spatial correlation than the measurements of poverty. Actually, the spatial correlation does not seem to be substantive although the index is statistically significant in all cases. Moran's I rounds to 0.10 at the levels of ECs, MxHCGUs, and ADPIs. Even if the values cannot be directly compared due to the difference in thresholds, they are all pretty small. About 4% of the ECs and 2% of the ADPIs are units with high values surrounded by neighbors with a comparable high number of parishes. There are about 5% MxHCGUs in the same situation; and 6% are areas with low values neighboring other areas with a low number of parishes. At the level of big localities, Moran's I has a value of 0.02, and 0.01 is the value for all localities together.

We can observe that the number of parishes seems to be much more dispersed than any of the predictors. There is a minimal spatial autocorrelation at the levels of all localities and big localities. At the level of aggregated areas, the correlation is not that small, but still it is not high, particularly compared to the autocorrelation of the predictors. These results indicate a limited spatial correlation in the regression models. Nonetheless, the predictors are sometimes highly auto-correlated. Therefore, we should still test for spatial autocorrelation to avoid bias in the standard errors of the coefficients, and add the average value of neighbors to orthogonalize the model when needed.

The map displays the localities with any number of parishes and particularly distinguishes those with the highest number of parishes (top 1%). Because we are dealing with counts, these top values usually fall in the area of MxHCGUs in the 99th percentile of the distribution of the counts of parishes (Figure 15).

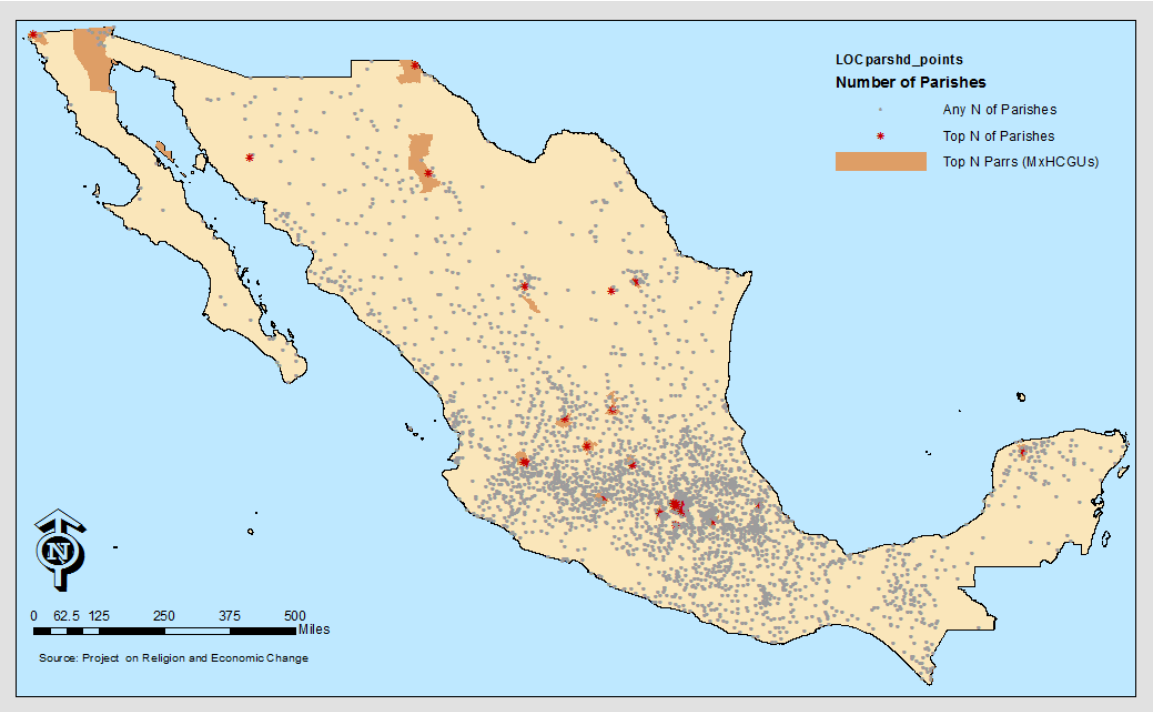

Figure 15: Map of Areas with Highest Number of Parishes.

We observe areas of higher concentration of exposure to pastoral services provided by parishes which seem broadly correspondent to areas with a concentration of poverty (probably due to higher population density). We will proceed now to model the data in order to find out if the relationship that we observe in the maps is statistically significant and we can reject the null hypotheses of negative or no correlation between pastoral services and the different measurements of poverty.

6.2. CORRELATION BETWEEN PASTORAL SERVICE AND POVERTY

Level of Circumscriptions

Ecclesiastical circumscriptions (ECs) are the basic units for storing data on pastoral services of the Catholic Church at the world level, and have been at least since the 17th century the basic jurisdictional object of the decisions of the bishops and the pope. Therefore this is the proper level for the initial exploration of the relationships between pastoral services and poverty.

In this case we want to test the hypothesis about the relationship between the number of parishes and the aggregated index of poverty, as well as the hypotheses about each one of the five dimensions of poverty. The tests will be performed using negative binomial models—as explained in the research design. We will be able to reject the null hypotheses of negative correlation or independence when the variables used to measure poverty have positive and statistically significant values, after including the pertinent controls. The first set of models is presented in Table 15. These are marginal effects models, without any other control variables.

	Model 1.1 (N = 91)	Model 1.2 (N = 91)	Model 1.3 (N = 91)	Model 1.4 (N = 91)	Model 1.5 (N = 91)	Model 1.6 (N = 91)	Model 1.7 (N = 91)
Poverty Index	0.0087 *						
Percentage of Households w/o Material Goods		0.0147 **					**0.0453** **
Percentage of Households w/o Running Water			0.0031				-0.0201 ***
Percentage of People w/o right to Health Services				0.0067 †			-0.0002
Percentage of Illiterate Population					0.0151 **		**0.0466** **
Percentage of Indigenous Language Speakers						0.004 †	-0.0164 **
Intercept	-9.753 ***	-9.693 ***	-9.673 ***	-9.855 ***	-9.764 ***	-9.666 ***	-9.782 ***
Over-Dispersion Parameter	0.097	0.096	0.101	0.098	0.093	0.099	0.080

Notes: † p ≤ .10 * p ≤ .05 ** p ≤ .01 *** p ≤ .001 (two tailed)

Table 15: Regression Models of Poverty: Data Aggregated by ECs.

We observe that the poverty index is positively correlated with the number of parishes (Model 1.1). Moreover, all the detailed dimensions of poverty are positively correlated with pastoral services, although not all coefficients are statistically significant (Models 1.3, 1.4, & 1.6). The two dimensions with greater and more significant correlation are the percentage of households deprived of material goods and the percentage of illiterate individuals aged 15 years or more (Models 1.2, 1.5, & 1.7).

We initially expected to find multicollinearity in the different dimensions of poverty, but when we include all five dimensions together in a conditional model, we see that the two coefficients that were most highly significant in the marginal models remain significant and gain magnitude in the conditional model (Model 1.7). On the other hand the coefficients for the other three dimensions change sign when they are included in the

conditional model where they become controls to each other. Therefore, when we control the five dimensions together, we observe that there are fewer parishes in places with higher percentages of households without running water or in indigenous areas. This also happens in areas with a higher percentage of inhabitants without the right to access health services, although this relationship is not statistically significant.

On the contrary, when we control for other dimensions of poverty, we expect to have more parishes in places with a higher percentage of households deprived of material goods and a higher percentage of illiteracy. It could be revealing to represent the relationship between the percentage of households deprived of material possessions and the number of parishes. If we fix the other variables at their mean values and we consider the number of parishes for every 10,000 people, Model 1.7 predicts, on average, the relationship represented in Figure 16.

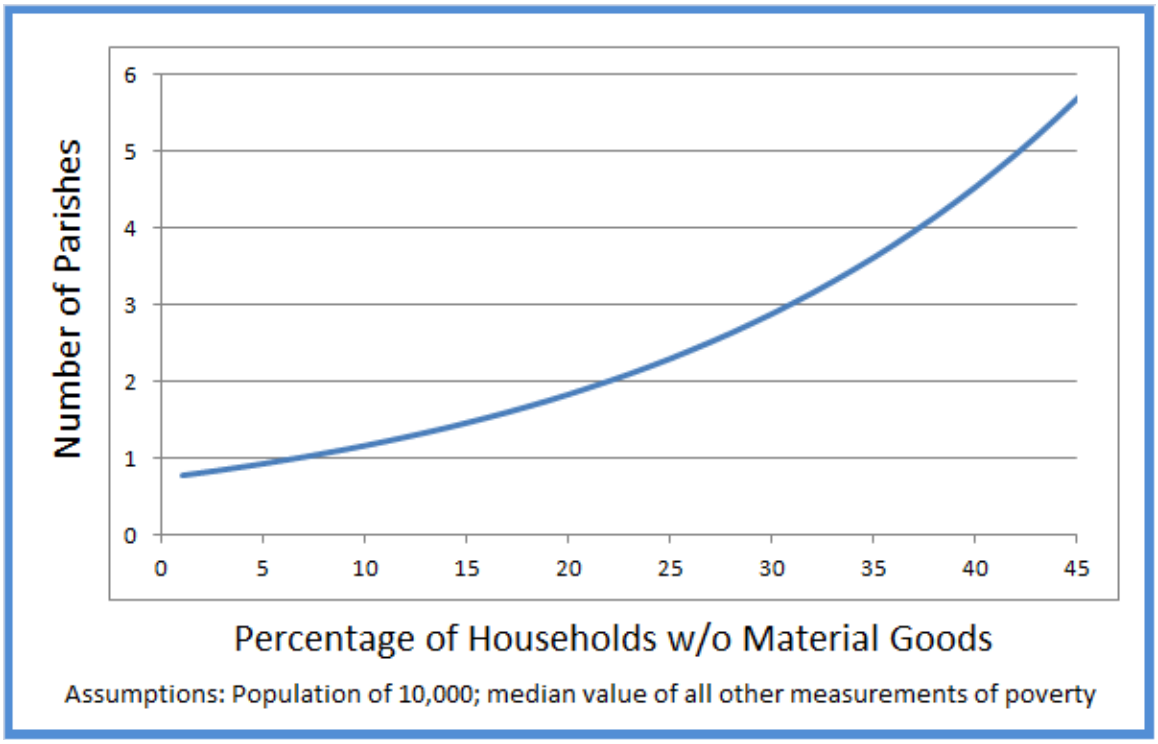

Figure 16: Expected Number of Parishes
by Percentage of Households w/o Material Goods.

Predicted values were calculated using the following formula, based on Equation 24 presented in the research design:

$$\hat{Y}_i = Population_i * e^{(\beta_0+\beta_1 X_{nogoods}+\beta_2 X_{nowater}+\beta_3 X_{nohealtplan}+\beta_4 X_{illeracy}+\beta_5 X_{indigenous})}$$

Equation 34: Expected values in Poisson regression

We can observe that the increase in the percentage of households lacking material goods has an important influence on the number of parishes. Something similar could be displayed if we predict number of parishes using the percentage of illiteracy or using the aggregated index of poverty. The curve would be about the same when representing the illiteracy rate on the *X* axis but less steep when representing the index of poverty (its coefficient is 0.009)

We should now add the control variables that we have presented in the research design as potentially influential in order to see if the relationship remains or the magnitude and significance are modified by adding those predictors. This is examined in Table 16.

	Model 1.1 (N = 91)	Model 2.2 (N = 91)	Model 2.3 (N = 91)	Model 2.4 (N = 91)	Model 2.5 (N = 91)	Model 2.6 (N = 91)
Poverty Index	0.0087 *	0.0091 **	0.0109 **	0.0102 **	-0.0089	-0.002
Percentage of Catholics		0.0194 ***		0.0086		0.0172 ***
Percentage of Protestants			-0.0318 ***	-0.0185		
Percentage of Rural Population					0.0092 ***	0.0057 *
Intercept	-9.753 ***	-11.38 ***	-9.486 ***	-10.32 ***	-9.791 ***	-11.22 ***
Over-Dispersion Parameter	0.097	0.064	0.063	0.062	0.086	0.061
	Notes: † p ≤ .10 * p ≤ .05 ** p ≤ .01 *** p ≤ .001 (two tailed)					

Table 16: Regression Models of Poverty Index with Covariates: Data Aggregated by ECs.

We keep Model 1.1 in the first column in order to compare coefficients when adding control variables. The percentage of Catholics has actually proved to be the strongest predictor of the number of parishes, as exhibited at every level of aggregation. Nevertheless the coefficient corresponding to the aggregated poverty index increases in magnitude and gains significance when we control for percentage of Catholics (Model 2.2). Therefore, even when we control for the Catholic population, we still find a significant association between the index of poverty and the number of parishes. We

mentioned that it should be important to explore whether the higher presence of Catholic pastoral services among the poor could be explained because of the competition. Nevertheless, when we include the percentage of Protestants, Evangelicals, Pentecostals and Neo-Pentecostals, we find that the coefficient for the index of poverty gains magnitude and significance whereas the coefficient for the percentage of other—broadly considered—Christians appears significant but with negative sign (Model 2.3). Therefore, we realize that pastoral services are fewer, on average, where there is a higher number of Protestants, when controlling for poverty. In contrast, we expect an increase in the number of parishes, which is positively associated with the index of poverty even after controlling for the percentage of broadly considered Protestants.

When we include the percentage of Catholics as well as the percentage of Protestants, we find that both variables keep their sign but decrease their magnitude and lose their significance (Model 2.4). This is due to both variables being highly correlated (r = -.94), implying that they are practically measuring the same thing. This is because in Mexico the Catholic population usually decreases as a natural effect of the growth of other non-Catholic Christian groups since other religious categories have a very small share of the population.

When we control for the percentage of rural population, we find that, on average, circumscriptions with a higher percentage of people living in rural areas have more parishes (Model 2.5). This removes the effect of the poverty index, by changing the sign of the coefficient and rendering it statistically insignificant. We also find that the index is highly correlated with the percentage of rural population (r = .81). We can explain this because the higher amount of rural inhabitants also indicates a more geographically disperse population, and people in rural areas are more likely to live in poor conditions because of the limitation of resources. Nevertheless the broader geographic distribution

of the population also implies that more parishes are needed to cover a bigger area. Rural percentage and the index of poverty are partially measuring the same thing. When we introduce the percentage of Catholics in a model already including the percentage of rural population, the effect of rural population decreases but it is not removed (Model 2.6). This is the most complete model in Table 16 and it improves the model fit when only including the percentage of Catholics, as can be verified by the likelihood ratio test (*chi square* = 5. 7; $p < .02$).

We should consider that in terms of this research there is no need to include the measurement of rural condition, since it is so closely associated with another measurement of poverty. Therefore we can consider Model 2.2 of Table 16 as the final model that we will select to test for spatial autocorrelation (results shown in Appendix B). The proportion of Catholics shows spatial variation; nevertheless, the test shows no evidence of spatial variation about the parameter of the poverty index, therefore there is no need to add any variable to orthogonalize the model.

When other covariates are added to the model that already includes the five dimensions of poverty, we get the coefficients shown in Table 17.

	Model 1.7 (N = 91)	Model 3.2 (N = 91)	Model 3.3 (N = 91)	Model 3.4 (N = 91)	Model 3.5 (N = 91)	Model 3.6 (N = 91)	Model 3.7 (N = 91)
Percentage of Households w/o Material Goods	0.0453 **	0.0387 *	0.0275 †	0.0325 †	0.0281	0.0088	0.0411 *
Percentage of Households w/o Running Water	-0.0201 ***	-0.0128 **	-0.0126 **	-0.0125 **	-0.0222 ***	-0.0155 ***	-0.0127 **
Percentage of People w/o right to Health Services	-0.0002	-0.0015	-0.0021	-0.0019	0.0048	0.0023	-0.0006
Percentage of Illiterate Population	0.0466 **	0.0247 †	0.0326 *	0.0285 †	0.0158	0.0109	0.0284 *
Percentage of Speakers of Indigenous Language	-0.0164 **	-0.0095 †	-0.0075	-0.0082	-0.0095 †	-0.0015	-0.0113 *
Percentage of Catholics		0.0173 ***		0.0083		-0.0094	0.0183 ***
Percentage of Protestants			-0.028 ***	-0.0153		-0.0399 *	
Percentage of Rural Population					0.0109 ***	0.0099 **	
Average N of Parishes in Neighboring ECs							-0.0062
Intercept	-9.782 ***	-11.13 ***	-9.447 ***	-10.25 ***	-9.979 ***	-8.744 ***	-10.82 ***
Over-Dispersion Parameter	0.080	0.058	0.056	0.057	0.072	0.052	0.057

Notes: † p ≤ .10 * p ≤ .05 ** p ≤ .01 *** p ≤ .001 (two tailed)

Table 17: Regression Models of Dimensions of Poverty Including Covariates: Data Aggregated by ECs.

In this case we keep Model 1.7 in the first column in order to be able to compare coefficients when adding control variables. Once we add the percentage of Catholics in the model, the coefficient for illiteracy remains only marginally significant (Model 3.2). The magnitude of the effect of the percentage of households lacking material goods diminishes but still remains statistically significant. We also notice that the negative coefficient of the percentage of households without running water is statistically significant. When we add the percentage of Protestants (broadly defined) instead of the percentage of Catholics, we obtain similar results for the effect of the percentage of households without running water, although in this case the effect of the percentage of illiterates remains significant but not the effect of the percentage of households with no material goods (Model 3.3). This means that despite the association between the percentages of Catholics and Protestants, each one of them seems to have a different

association with the different dimensions of poverty. When we include both measurements together in the model only the negative coefficient for the percentage of households lacking running water remains significant (Model 3.4). Therefore, when including both controls, even if none of them is significant because both are strongly correlated—as already has been shown—we observe that, on average, fewer parishes are located in places with a higher percentage of households without running water.

Since the lack of urban infrastructure could probably explain the high percentage of households without running water, it is interesting to observe the coefficients when adding the percentage of rural population to the model. But against our expectations, when we add such control by itself we notice that the significance of all coefficients vanishes, except for the negative coefficient tapping the effect of limited availability of water in households (Model 3.5). Even when adding all the control variables in the model, this effect remains significant (Model 3.6).

When we consider the results of the models, we can state that there is a positive association between pastoral services and lack of material goods, even when controlling for the percentage of Catholic population. Nevertheless the significance does not remain when we add the percentage of Protestants or the percentage of rural population. This does not favor the argument about religious competition being the explanation for the option for the poor, because the coefficient for the percentage of Non-Catholic Christians is always negative.

The models show, in contrast, that the dimension of poverty as measured by the limited access to running water is negatively associated with the provision of pastoral services when we add other controls (Model 3.6). On the other hand, the lack of material goods remains significant when we add the percentage of Catholics (Model 3.2). Although the statistical significance vanishes with other controls, we are not aware of any

theoretical reasons for including such variables in the model. The proportion of rural population is a measure of poverty. The proportion of Protestants has a particular relationship with poverty, but that is not the object of this study and there is no evidence that religious competition is modifying the relationship between poverty and pastoral service. Therefore, we keep Model 3.2 to be tested for autocorrelation.

When the test is performed, we reject the null hypothesis of no spatial variation (results shown in Appendix C). Therefore we should add the average number of parishes in neighboring ECs, i.e., those inside the threshold calculated by the geographically weighted regression (955.5 km). When adding those values, in order to orthogonalize the model, we find an inverse association of this average and the actual number of parishes, which is not statistically significant (model 3.7). The negative coefficient corresponding to the percentage of households deprived of running water remains significant and the negative coefficient for the percentage of indigenous population becomes significant. The positive coefficient for material poverty remains significant and the positive coefficient for illiteracy rate becomes significant. Both positive coefficients retain their magnitude.

Ecclesiastical circumscriptions are a main level for aggregating the data on Catholic pastoral care. Trends in bishops' decisions have been tested at that level and we found that the number of parishes is correlated with the index of poverty. Therefore we can reject the null hypothesis of negative or no correlation between the index of poverty and the number of parishes at the level of ecclesiastical circumscriptions. We can also reject the null hypothesis of negative or no correlation between the number of parishes and two dimensions of poverty: the lack of material goods in the household and the illiteracy rate. Nevertheless, at the level of ECs, we failed to reject any of the other null hypotheses presented in the research design. The analysis of lower levels of aggregation will test if the internal distribution of pastoral care inside the circumscriptions also

appears to be correlated in any way to multidimensional poverty.

Level of MxHCGUs

We explained the importance of subdividing municipalities in order to allocate accurately the population and significant areas to their corresponding ecclesiastical circumscriptions (ECs). The subdivision will also make it possible to use these units to link longitudinal data from past censuses, which are also available at the level of municipalities. These sub-municipalities are the first set of Maximum Historically Consistent Geographic Units (MxHCGUs) and they will be subdivided into smaller units, as needed, in order to link historical data. We use them now at this level to test the relationship between poverty and pastoral service—and do the same for the hierarchical models. This is not a proper level of aggregation of the data on Catholic pastoral services, but it is a proper, as well as the most common, level of aggregation of socio-demographic data, as outlined earlier. The null hypotheses of negative correlation or independence will be tested in a manner similar to what has been done at the ECs level.

The (marginal) models without any other controls are shown in Table 18.

	Model 4.1 (N = 2490)	Model 4.2 (N = 2490)	Model 4.3 (N = 2490)	Model 4.4 (N = 2490)	Model 4.5 (N = 2490)	Model 4.6 (N = 2490)	Model 4.7 (N = 2490)
Poverty Index	0.0003						
Percentage of Households w/o Material Goods		0.0018					0.0007
Percentage of Households w/o Running Water			-0.0009				-0.0056 ***
Percentage of People w/o right to Health Services				0.0025 *			0.0008
Percentage of Illiterate Population					0.007 ***		**0.0269** ***
Percentage of Indigenous Language Speakers						-0.0014 †	-0.0076 ***
Intercept	-9.66 ***	-9.664 ***	-9.641 ***	-9.746 ***	-9.728 ***	-9.641 ***	-9.802 ***
Over-Dispersion Parameter	0.073	0.073	0.074	0.072	0.068	0.074	0.060

Notes: † p ≤ .10 * p ≤ .05 ** p ≤ .01 *** p ≤ .001 (two tailed)

Table 18: Regression Models of Poverty: Data Aggregated by MxHCGUs.

We observe that the relationship between the number of parishes and the variables measuring poverty—and its different dimensions—is weaker at this level of aggregation. The coefficient of the aggregated index of poverty (Model 4.1) fails to reach statistical significance, as do the coefficient of the percentage of households lacking material goods (Model 4.2). The percentage of households not having running water (Model 4.3) and the percentage of the population speaking indigenous language (Model 4.6) have negative coefficients although both are statistically insignificant. The coefficient for the percentage of people not having the right to health services (Model 4.4) as well as the coefficient for the percentage of the population who are illiterate (model 4.5) are both positive and reach statistical significance.

It is important to understand the lack of statistical significance at this level before

considering the model including all the dimensions together. In order to do this, we can compare the distribution of the aggregated index of poverty, because it is a variable that was strongly significant at the level of ECs but is insignificant at the level of MxHCGUs. The scatter plot is shown in Figure 17.

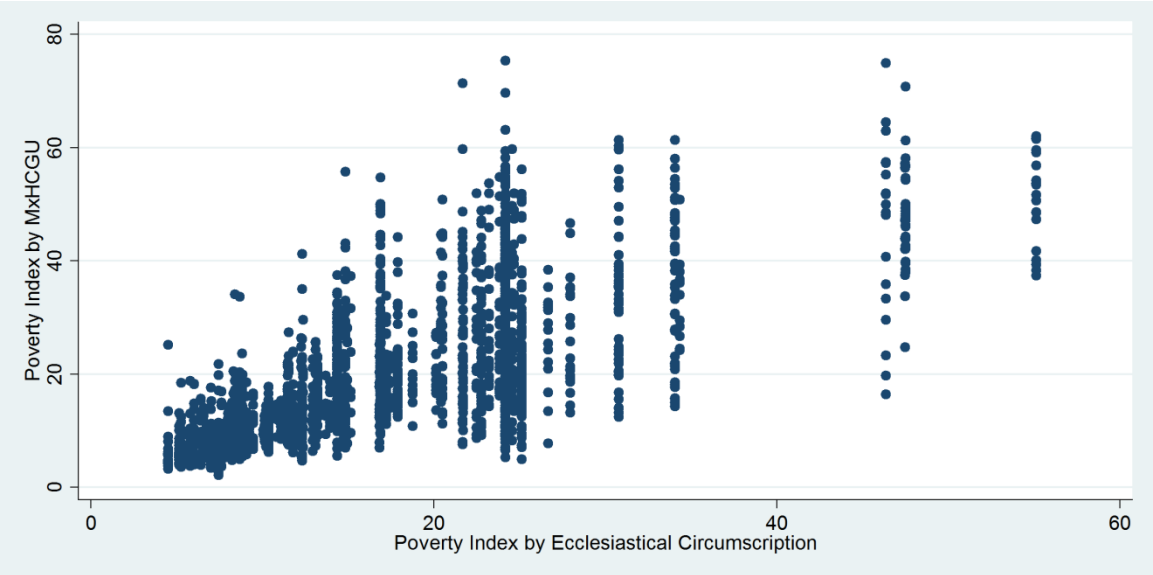

Figure 17: Scatterplot of Poverty Index by ECs and MxHCGUs.

The distribution by MxHCGUs has broader dispersion. Such dispersion is particularly noticeable for the values aggregated at the lower middle part of the distribution by ECs. The aggregation rendered the poverty index by EC significant, but when disaggregated by MxHCGUs the distribution is different and there is no significant correlation of the poverty index and the number of parishes. We are facing a clear example of the Modifiable Areal Unit Problem that was discussed in the research design. In order to find consistency in the correlation at the different levels of aggregation it is necessary to also have a similar distribution at the different levels of the variables involved.

When all the different dimensions of poverty are included in the same model we observe that the only positive and significant coefficient is the one corresponding to the percentage of illiterate population (Model 4.7). The negative coefficient for the percentage of households not having running water is also significant, as well as the negative coefficient for the percentage of indigenous people. These coefficients show that higher percentages of indigenous people or higher percentages of households lacking running water are associated with a lower number of parishes, on average, when we test the relations at the level of the MxHCGUs. On the contrary, we expect to have more parishes in places with higher rates of illiteracy when we control for other dimensions of poverty.

In Table 19 we can observe in which ways the control variables make any difference, at this level of aggregation, when they are added to the model already including the five dimensions of poverty.

	Model 4.7 (N = 2490)	Model 5.2 (N = 2490)	Model 5.3 (N = 2490)	Model 5.4 (N = 2490)	Model 5.5 (N = 2490)	Model 5.6 (N = 2490)
Percentage of Households w/o Material Goods	0.0007	0.0088 *	0.0068	0.0085 †	-0.0084 †	0.0085 †
Percentage of Households w/o Running Water	-0.0056 ***	-0.0033 **	-0.0034 **	-0.0033 **	-0.008 ***	-0.0033 **
Percentage of People w/o right to Health Services	0.0008	-0.0005	-0.0005	-0.0006	0.0032 *	-0.0006
Percentage of Illiterate Population	0.0269 ***	0.0144 ***	0.019 ***	0.0153 ***	0.0055	0.0153 ***
Percentage of Speakers of Indigenous Language	-0.0076 ***	-0.0049 ***	-0.0047 ***	-0.0048 ***	-0.0036 **	-0.0048 ***
Percentage of Catholics		0.02 ***		0.0152 ***		0.0151 ***
Percentage of Protestants			-0.0302 ***	-0.0081		-0.0082
Percentage of Rural Population					0.0085 ***	
Average N of Parishes in Neighboring MxHCGUs						-0.001
Intercept	-9.802 ***	-11.43 ***	-9.494 ***	-10.95 ***	-9.944 ***	-10.94 ***
Over-Dispersion Parameter	0.060	0.049	0.047	0.048	0.056	0.048
	Notes: † p ≤ .10 * p ≤ .05 ** p ≤ .01 *** p ≤ .001 (two tailed)					

Table 19: Regression Models of Dimensions of Poverty Including Covariates: Data Aggregated by MxHCGUs.

Model 4.7 appears in the first column to facilitate the comparison of it to the models when adding control variables. The addition of the percentage of Catholics to the model results, as expected, in a positive and significant coefficient (Model 5.2). It does not remove the significance of any coefficient but actually gives statistical significance to the positive coefficient of the percentage of households without material goods, and increases its magnitude. This means that there are higher percentages of Catholics in units of analysis with less material deprivation and more parishes; therefore, when we add the variable we discover the effect of material poverty net of the percentage of Catholics. Both negative coefficients for the percentages of access to running water and of indigenous population decrease their magnitude. The size of the coefficient for illiteracy

also diminishes although it remains significant.

If instead of the percentage of Catholics we add the percentage of broadly defined Protestants to the model, the results are pretty similar although the coefficient for lack of material goods does not attain significance (Model 5.3). In this case, a higher percentage of Protestants is associated with units of analysis with more material poverty and fewer parishes. Therefore, including the percentage of Protestants increases the magnitude of the coefficient of material poverty, although it does not render the variable statistically significant. Similar results are also obtained when both percentages—of Catholics and Protestants—are included together in the model. In this case, the dimension of deprivation of material goods attains marginal significance only (Model 5.4). We notice that when the percentage of Protestants is included in the model, its coefficient is always negative. Besides, the effect is insignificant when the percentage of Catholics is also included, but we already mentioned that the percentage of Catholics and the percentage of Protestants could have a different relationship with the other variables—as in the case of material poverty.

Compared to the model without controls (Model 4.7), we observe many changes when the percentage of rural population is included as a control variable (Model 5.5). The coefficient for the rate of illiteracy becomes insignificant and smaller in magnitude. The negative coefficient for the percentage of households deprived of running water slightly increases in magnitude and remains statistically significant. The negative coefficient for the percentage of indigenous population also remains significant, although it decreases in magnitude. The coefficient for the percentage of individuals not having the right to health services remains positive, increases in magnitude and attains significance. This means that controlling for the percentage of rural population reveals a positive association between pastoral services and the percentage of the population without the right of

accessing health services. In contrast, the coefficient for the percentage of households without material goods changes sign, increases in magnitude, and attains significance. This means that when controlling for the percentage of rural population and the other dimensions of poverty, the lack of material goods is negatively associated with the number of parishes. In sum, the changes in the coefficients seem to be related to the particular association of the percentage of rural population with different dimensions of poverty. We can also observe at this level that the percentage of rural population is a measurement of poverty because of the marginalization of rural areas. In addition to this situation, there are no theoretical reasons for including this variable in the model at the level of MxHCGUs.

The model including the percentage of Catholics and the percentage of Protestants (Model 5.4) seems to be the most powerful at this level and was tested for spatial autocorrelation. We decided to retain both variables because, although they are correlated, the significance of the most relevant (Catholic percentage) is not eliminated when including the percentage of Protestants. This percentage could be in this case a proxy for identifying the lack of historical Catholic pastoral services in some municipalities with more material poverty, and we want to avoid any overestimation of statistical significance of poverty.

The results of the geographically weighted regression (GWR) led us to reject the null hypothesis of no spatial variation (see results in Appendix D). In order to orthogonalize the model, we also included the average number of parishes in neighboring MxHCGUs. In this case the threshold for the GWR and for the calculation of the average values of the neighboring units of analysis is 250 km, as explained in the research design. The coefficient for the average number of parishes in the neighboring MxHCGUs is very small, negative and not statistically significant (Model 5.6). All the other values remain

similar in terms of sign, magnitude, and significance, compared to model 5.4.

The results of the models at the MxHCGU level imply that we can reject the null hypothesis of negative or no correlation between the number of parishes and the percentage of illiterates in the units of analysis. However, we cannot reject any other null hypothesis regarding the other four dimensions of poverty or regarding the aggregated index of poverty. We should note that, on the one hand municipalities are a proper level for testing socio-demographic variables, but on the other hand such aggregation is not as adequate when dealing with pastoral services. As explained, the minimum level of the organization of pastoral services is the parish, which will be the level of aggregation for the next section of our analysis.

Level of ADPIs

Although the locality where each parish is settled has been identified, we already discussed that localities are not the best minimum level of aggregation. The parishes in rural areas provide pastoral services to neighboring localities, configuring the geographical regions that we have labeled as Areas of Direct Pastoral Influence (ADPIs). These could be considered the minimum geographic unit of analysis for the provision of pastoral services. Similar procedures to those used in previous sections will be used here to test at this level the null hypotheses of negative correlation or independence between the measurement of poverty and the measurements of pastoral service. We show the results of the marginal effects models in Table 20, before the addition of other control variables.

	Model 6.1 (N = 2997)	Model 6.2 (N = 2997)	Model 6.3 (N = 2997)	Model 6.4 (N = 2997)	Model 6.5 (N = 2997)	Model 6.6 (N = 2997)	Model 6.7 (N = 2997)
Poverty Index	0.0223 ***						
Percentage of Households w/o Material Goods		0.0398 ***					**0.0186** ***
Percentage of Households w/o Running Water			0.0088 ***				-0.0005
Percentage of People w/o right to Health Services				0.005 ***			-0.0044 ***
Percentage of Illiterate Population					0.0437 ***		**0.0629** ***
Percentage of Indigenous Language Speakers						0.0056 ***	-0.0149 ***
Intercept	-9.389 ***	-9.225 ***	-9.165 ***	-9.208 ***	-9.533 ***	-9.085 ***	-9.504 ***
Over-Dispersion Parameter	0.176	0.170	0.201	0.218	0.126	0.207	0.109
	Notes: † p ≤ .10 * p ≤ .05 ** p ≤ .01 *** p ≤ .001 (two tailed)						

Table 20: Regression Models of Poverty: Data Aggregated by ADPIs.

The poverty index appears positively correlated with the number of parishes (Model 6.1). All the detailed dimensions of poverty are also positively correlated with the number of parishes, as when running the analysis at the level of ECs. In addition, all the coefficients are statistically significant: the percentage of households deprived from material goods (Model 6.2), the percentage of households without access to running water (Model 6.3), the percentage of the population not having the right to health services (Model 6.4), the percentage of illiterate people (Model 6.5), and the percentage who speak an indigenous language (Model 6.6).

When we include all the dimensions of poverty in a single model, we do not observe the expected multicollinearity among the different dimensions of poverty. The coefficients correspond to different dimensions of poverty that do not have similar values

for the same unit of analysis. The two coefficients that were stronger at the level of ECs are also the ones retaining their sign and significance; in addition, they increase in magnitude (Model 6.7). The other three dimensions change sign as we also observed when using the model at the level of ECs, although the coefficient for the percentage of households without running water is not significant in this case, whereas the negative coefficient for health services, which was not significant at the ECs level, is significant here.

When controlling simultaneously for the five dimensions of poverty, we expect to find fewer parishes in places with a higher percentage of people with limited access to health services or with a higher percentage of indigenous population. In contrast, we expect more parishes in places where there is a higher percentage of households deprived of material goods and a higher percentage of illiteracy.

We do not display results of models that include the percentage of Protestants or the percentage of rural population. Such controls do not add any interesting changes in the coefficients of the variables of interest at this level of aggregation (not even in the models including all areas of reference). There is no theoretical reason to add the percentage of rural population because it is also a measure of poverty. The percentage of Protestants was included to control for competition, but it is always negatively related to the number of parishes or not significant. In both cases, it does not change sign or magnitude of the coefficients for the measurements of poverty. Nonetheless, in order to avoid the validation of spurious relations, we should add the strongest control we have, which is the percentage of Catholic population. The results are displayed in Table 21.

	Model 6.1 (N = 2997)	Model 7.2 (N = 2997)	Model 7.3 (N = 2997)	Model 6.7 (N = 2997)	Model 7.5 (N = 2997)	Model 7.6 (N = 2997)
Poverty Index	0.0223 ***	0.023 ***	0.0219 ***			
Percentage of Households w/o Material Goods				0.0186 ***	0.0191 ***	0.0193 ***
Percentage of Households w/o Running Water				-0.0005	0.0013	0.0012
Percentage of People w/o right to Health Services				-0.0044 ***	-0.0066 ***	-0.0066 ***
Percentage of Illiterate Population				0.0629 ***	0.0538 ***	0.0533 ***
Percentage of Indigenous Language Speakers				-0.0149 ***	-0.0116 ***	-0.0116 ***
Percentage of Catholics		0.0283 ***	0.028 ***		0.0232 ***	0.0231 ***
Average N of Parishes in Neighboring ADPIs			-0.0387 **			-0.0092
Intercept	-9.389 ***	-11.89 ***	-11.75 ***	-9.504 ***	-11.4 ***	-11.38 ***
Over-Dispersion Parameter	0.176	0.134	0.133	0.109	0.089	0.089

Notes: † p ≤ .10 * p ≤ .05 ** p ≤ .01 *** p ≤ .001 (two tailed)

Table 21: Regression Models of Poverty Indicators by ADPIs: Percentage of Catholics as Control Variable.

The coefficients in the first column from Model 6.1 facilitate comparisons of the results when the control variable is added to the model. The percentage of Catholics is found to be significant when added to the model and has a positive coefficient. We observe that neither the magnitude nor the statistical significance of the coefficient for the aggregated index is removed by the control variable (Model 7.2).

The right side of the table starts displaying the coefficients when using the five dimensions of poverty (Model 6.7). These results can be compared to the results after

controlling for the percentage of Catholics. Once the variable is added, it has a positive and significant coefficient (Model 7.5). The positive coefficient for the percentage of illiterate people remains significant and slightly decreases its magnitude. The positive coefficient for the percentage of households not having material goods also remains significant and roughly maintains the same size. The negative coefficients for the rate of indigenous people and right to health services also remain significant and of about the same magnitude. The coefficient for the percentage of households deprived of running water changes sign but remains insignificant.

The test for spatial autocorrelation of the models controlling for the percentage of Catholics is performed using the threshold of 150 km for this level, as explained in the research design. The tests reveal spatial variation in the model including the index of poverty plus the control for the percentage of Catholics (see Appendix E) and the model including the five measurements of the dimensions of poverty as well as the percentage of Catholics (results in Appendix F).

Once the average number of parishes in neighboring ADPIs is added to the models in order to orthogonalize them, we can observe that there are not important changes in the other variables. The average outcome of neighbors has a negative coefficient, but it is significant and bigger when controlling for the index of poverty (Model 7.3). In the model including the separate dimensions of poverty, the relevance of neighbors is smaller and statistically insignificant (Model 7.3). The index of poverty has a slight decrease in magnitude (Model 7.3). In the model using the dimensions of poverty (Model 7.6), the negative coefficient for the percentage of indigenous population remains the same, as well as the negative coefficient for the percentage of the population not having the right to health services. The coefficient for the percentage of households without running water remains insignificant although slightly decreased. The control for

the percentage of Catholics remains significant and has also a slight decrease in magnitude. In a similar way, the positive and significant coefficients for the other two dimensions of poverty only have slight changes in their size. The relation of pastoral service to the percentage of households without material goods remains positive and significant; this also happens to the relation of pastoral service to the illiteracy rate.

At the level of ADPIs, we can reject the null hypothesis of negative or no correlation between pastoral services and the aggregated index of poverty. Considering all areas having some direct pastoral influence, we expect to find more parishes in areas with higher values of the aggregate index of poverty. In a similar vein, the null hypothesis can be rejected regarding independence or negative association between the number of parishes and the percentage of households without material goods, and between the number of parishes and the percentage of the illiterate population. We expect to have more parishes, on average, where we find higher values of both dimensions of poverty. We cannot reject the null hypotheses regarding the other three measurements of poverty. On the contrary, the higher percentage of people without the right to receive health services and the higher rate of indigenous population are associated with a smaller number of parishes on average.

It is important to remember that when the ADPIs include rural areas, they are more likely to have only one church, whereas a larger number of churches would be concentrated in urban areas. Therefore, the trends that we can find when rejecting the null hypothesis provide evidence of the option for the poor even when considering such a limited number of parishes in rural areas that we know are usually associated with more poverty.

Nevertheless there is an important limitation using ADPIs because the aggregation of data by these units is defined by the estimation of pastoral influence;

therefore, the data excludes by definition all places where there is no such influence. The analysis of this level of aggregation can help us to understand trends of pastoral service among places where there is some pastoral service, but we need to compare these trends to areas where there are no parishes in order to understand a more general pattern of the geographical distribution of parishes, as presented in the following section.

Integration of All Reference Areas

In order to be able to compare the Areas of Direct Pastoral Influence (ADPIs), it is necessary to create relatively comparable geographic units of aggregation of the data. The areas created with this objective are added to the ADPIs to complete a list of areas of reference. The most relevant results of testing the null hypotheses using this set of units of analysis are displayed in Table 22.

	Model 8.1 (N = 24,940)	Model 8.2 (N = 24,940)	Model 8.3 (N = 24,940)	Model 8.4 (N = 24,940)	Model 8.5 (N = 24,940)
Percentage of Households w/o Material Goods			-0.0203 ***	-0.0127 **	-0.0125 **
Percentage of Households w/o Running Water			-0.007 ***	-0.0056 ***	-0.0058 ***
Percentage of People w/o right to Health Services	0.002 *		0.0035 ***	0.0024 *	0.0027 *
Percentage of Illiterate Population		-0.005 **	0.0172 ***	0.0078 *	0.0057 †
Percentage of Indigenous Language Speakers			-0.0018 †	0.0004	0.0004
Percentage of Catholics				0.0222 ***	0.0228 ***
Average N of Parishes in Neighboring Areas					-0.222 **
Intercept	-9.736 ***	-9.617 ***	-9.755 ***	-11.59 ***	-11.55 ***
Over-Dispersion Parameter	0.063	0.070	0.067	0.058	0.055
	Notes: † p ≤ .10	* p ≤ .05	** p ≤ .01	*** p ≤ .001 (two tailed)	

Table 22: Regression Models of Poverty: Data Aggregated by Areas of Reference.

The table does not display any result for coefficients not relevant in terms of the rejection of the null hypothesis (all marginal effects models at this level are displayed in Appendix G). We cannot reject the null hypothesis that the poverty index is independent or negatively correlated with the number of parishes, but despite such results we find that there are dimensions of poverty which seem to be associated with pastoral service. The models with one predictor show that the coefficient for the percentage of people deprived of the right to health services is positive and significant (Model 8.1), in contrast, the

coefficient for the percentage of illiterate population is significant but negative (Model 8.2). When we include all the dimensions of poverty together and they control for each other, both coefficients are positive: the coefficient for limited access to health services remains positive, increases in magnitude, and becomes even more significant; the coefficient for the rate of illiteracy is also significant but it becomes positive and increases its size (Model 8.3). The other three coefficients are negative. Whereas the coefficients for the percentage of households lacking material goods or lacking running water are significant, the coefficient for the percentage of indigenous population is only marginally significant.

When the control for the percentage of Catholics is included in the model, the two negative coefficients that were significant retain their significance and roughly their magnitude (Model 8.4). The coefficient for the percentage of indigenous population changes sign, becomes very small and is insignificant. The positive coefficient for the percentage of people without the right to health services retains its sign and decreases in magnitude although it remains statistically significant. The other positive coefficient, corresponding to the rate of illiteracy also retains its sign and significance, although it decreases in magnitude even more than the others.

The test of spatial independence gives evidence to reject the null hypothesis (results shown in Appendix H). As explained in the research design, we use a threshold as of 150 km. The average number of parishes in neighboring areas, when added to the model, shows a negative and significant coefficient. We already realized that the number of parishes appeared negatively associated with the average value of neighbors when using the set of ADPIs. The percentage of Catholics, which has been the most important predictor, retains its significance, sign and is very similar in magnitude. Most of the other coefficients also remain unchanged. The statistically insignificant coefficient for the

percentage of indigenous population remains the same; the negative and significant coefficients remain almost unchanged as well. The coefficient for the percentage of people with limited access to health services retains sign and significance and slightly increases its size. The coefficient for the percentage of illiterate population loses significance and decreases: the lower number of parishes in neighboring areas explains the effect of the illiteracy rate by removing its significance.

In sum, we can reject the null hypothesis of negative or no correlation between pastoral services and the percentage of people with limited access to health services. We expect to find more parishes in the areas of reference with higher percentages of population not having the right to health services. Once we integrate the average of parishes in neighboring areas, we cannot reject any other null hypothesis. This raises the question about the mechanism leading to the significance of a dimension of poverty that has not been relevant in former models to predict the increase in the number of parishes. The comparison of total values of poverty measurements (Table 23) will help us to answer the question.

	ADPIs	Other areas of reference	All other localities
Number of localities:	42,545	73,175	149,390
Number of Parishes:	6,587	-	-
Total Population:	88,739,346	21,300,952	23,545,343
Percentage of Catholics	83.30	80.47	80.63
Percentage of Households w/o Material Goods	1.27	8.43	8.91
Percentage of Households w/o Running Water	7.05	26.21	28.42
Percentage of People w/o right to Health Services	33.14	36.32	36.55
Percentage of Illiterated Population	4.76	15.13	15.41
Percentage of Speakers of Indigenous Language	3.60	18.32	17.89
Poverty Index	9.96	20.88	21.44

Table 23: Comparison of Measures at Different Levels of Aggregation.

There are 42,545 localities and 6,587 parishes included in the 2,997 ADPIs, whereas there are 73,175 localities in the aggregated areas we created as areas of reference and 149,390 localities not included in ADPIs in total. The population having direct pastoral influence equals 88,739,346 people, and 23,545,343 inhabitants, in total, are deprived of such influence. Therefore, we observe that most of the population, almost 80%, lives in areas of direct influence of parishes. The percentage of Catholics is not that different when comparing the total population exposed to direct pastoral influence to those living relatively far from parishes, although there are 3% more Catholics in the ADPIs. The models including only ADPIs are justified because those areas encompass most of the population and almost the same percentage of Catholics.

However, the model including all reference areas makes sense when comparing some characteristics of populations directly exposed to those not directly exposed to

pastoral services. The aggregated index of poverty and the five percentages used to measure dimensions of poverty are higher in the areas not exposed to direct influence of parishes. The index is only about twice as big, but most dimensions have bigger differences: The percentage of illiterate population is 3.2 times bigger and the percentage of households without running water is about 3.7 times bigger. The percentage of indigenous population is about 5 times bigger whereas the percentage of households deprived of material goods is roughly 6.6 times bigger.

All these percentages show that there is more poverty in locations relatively far from parishes. The characteristics of these locations could make them more difficult to access, also explaining the lack of parishes. However, in terms of pastoral service, it seems that most null hypotheses cannot be rejected when modeling all the locations that could be included in a reference area.

The percentage of population without the right to access health services is the dimension of poverty with the most similar values among ADPIs, other areas of reference, and all other localities. Whereas 33% of people living in areas exposed to direct pastoral influence have limited access to health services, roughly 36% to 37% have that limitation in localities relatively far from parishes. From this we understand that the positive association of the percentage of the population deprived of health services and the number of parishes appears only at the lowest levels of aggregation, because the areas with and without parishes have similar values on this measure and the number of units of analysis favor the statistical significance.

The analyses performed in the former sections provide considerable support to answer our research question about the empirical evidence of the option for the poor in terms of pastoral service. We discover that the relationship between measures of poverty and the number of parishes varies for diverse dimensions of poverty and different levels

of aggregation. This evidence indicates various priorities of the Mexican Catholic Church. The results at different levels of analysis also help us to answer the methodological question about the consistency of the different levels of analysis. However the results can be extended to test our null hypothesis by means of a hierarchical model, which will be the subject of the following section.

Hierarchical Models Including Circumscriptions and Municipalities

The municipalities are the most detailed level of aggregation of socio-demographic data of Mexico, but the proper units to store and understand data on Catholic pastoral services are the Ecclesiastical Circumscriptions (ECs). We have already presented the way to normalize both kinds of data using the Maximum Historical Consistent Geographic Units (MxHCGUs). This section presents hierarchical models that include both levels of analysis.

The main difference in terms of data in this section compared to the analysis at the level of MxHCGUs is that the outcome (number of parishes) and the exposure (total population) are aggregated by ECs, whereas the predictors are at the level of MxHCGUs. This is consistent with the maximum detail that we could find when using historical data. Pastoral services are reported at this level in the main sources of the Catholic Church, such as the Pontifical Yearbook that was used for checking the number of parishes (AP, 2009, 2010, 2011, 2012). Socio-demographic data from former Mexican census waves are published at the municipality level, and the data should be distributed in MxHCGUs because some municipalities split into more than one EC. Although we initially expected that this multilevel test would provide evidence to reject some of the null hypotheses, we can observe that no coefficient for measurements of poverty reaches statistical significance (Table 24).

	Model 9.1 MxHCGUs = 2,490 ECs = 91	Model 9.2 MxHCGUs = 2,490 ECs = 91	Model 9.3 MxHCGUs = 2,490 ECs = 91	Model 9.4 MxHCGUs = 2,490 ECs = 91	Model 9.3 MxHCGUs = 2,490 ECs = 91	Model 9.4 MxHCGUs = 2,490 ECs = 91
Poverty Index	0.00030	0.00250	0.00300			
Percentage of Households w/o Material Goods				-0.00830	-0.00300	-0.00240
Percentage of Households w/o Running Water				-0.00080	-0.00040	-0.00030
Percentage of People w/o right to Health Services				0.00140	0.00020	0.00040
Percentage of Illiterate Population				0.00690	0.00320	0.00330
Percentage of Speakers of Indigenous Language				0.00060	0.00130	0.00110
Percentage of Catholics		0.01080 ***	0.01090 ***		0.01060 ***	0.01070 ***
Average N of Parishes in Neighboring Ecs			-0.00300			-0.00210
Intercept	-11.4500 ***	-12.0700 ***	-11.9100 ***	-11.4900 ***	-12.0500 ***	-11.9400 ***
Over-Dispersion Parameter ln(r)	4.45	4.25	4.42	4.58	4.30	4.40
Over-Dispersion Parameter ln(s)	6.22	5.68	5.90	6.32	5.73	5.85
Deviance (−2LL):	23,389	22,881	22,865	23,299	22,851	22,844

Notes: † p ≤ .10 * p ≤ .05 ** p ≤ .01 *** p ≤ .001 (two tailed)

Table 24: Multilevel Models of Poverty: Outcome by ECs, Predictors by MxHCGUs.

We are actually dealing with consequences of the different distributions of the variables at the level of MxHCGUs compared to the aggregation by ECs. This has already been explained when addressing the differences of the MxHCGUs level, when coefficients lost their power compared to those at the level of the ECs.

The number of Catholics is the main predictor when using a multilevel model. We added the average of neighbors used in the models by EC, and such variable does not result significant and does not remove the effect of the percentage of Catholic population. Therefore this analysis shows that when considering the dispersion at the MxHCGUs level, we cannot reject the null hypotheses of negative or no correlation between pastoral services and poverty, and the main predictor of the number of parishes is the percentage of Catholics.

If the data have distributions similar to those observed in the cross-sectional analysis, when adding more observations, the dimension of educational disadvantage would be the most interesting relationship because of its sign and magnitude.

Although this analysis does not help us to reject any null hypotheses, we have plenty of interesting results from other models that will be summarized in the next and last chapter. However, notice that the multilevel analysis is still promising if used with historical data. The analytical tool will probably become relevant then.

Chapter 7: Conclusions

I have presented how the official statements of the Catholic Church have declared a preferential option for the poor. There has been some research addressing the religious phenomenon and the ways it has changed in Latin America and, particularly, in Mexico. However, among the studies of the Catholic Church there has not been a quantitative approach merging socio-demographic variables and data on the provision of pastoral services. I have not found a study testing the Church's implementation of its preferential option for the poor in terms of the location of pastoral services. Although there are different sources—published and unpublished—to measure the activity of the Catholic Church, this research has been the first systematic effort to process the available information in such a way that makes it possible to properly integrate the religious data with the state's census and survey results.

The research question leading this study asked for empirical evidence of the Catholic Church prioritizing the pastoral service to the poorest population of Mexico. I used the processed data in order to model the number of parishes using the different measurements of multidimensional poverty, controlling for the most relevant factors. The comparison of the different results also makes it possible to answer the methodological question about the consistency of the different levels of aggregation regarding the priority of the poor for the Catholic pastoral work.

I will present in this section the conclusions of my study—my answer to the research question—by addressing each one of the hypotheses enunciated in the research design. After that I will also consider some other conclusions coming from the integration of different control variables in the models and from the levels of aggregation. I will end the chapter presenting some important pending tasks in my research agenda.

7.1. EVALUATION OF THE RESEARCH HYPOTHESES

The Index of Multidimensional Poverty

The index of multidimensional poverty aggregates the five measurements of the selected dimensions of poverty in a variable which could go from 0 to 100. It gives the same weight to each dimension. Its main limit is that it comes from aggregated data, but it is a good proxy for identifying areas where measurements of poverty are coincident in high or low percentages of poor people and of poor households considering the dimensions included in this research.

The null hypothesis for the index was stated:

- H_{00}: The number of parishes is negatively, or not, correlated to the aggregated index of poverty.

Therefore,

- H_{A0}: The number of parishes is positively correlated to the aggregated index of poverty.

At the level of ECs, we can reject the null hypothesis. The control for rural proportion removes the effect, but it is because the rural condition can be considered an alternative measurement of poverty. Therefore ECs having a higher index of poverty would have, on average, a higher rate of parishes. We can also reject the null hypothesis at the level of the ADPIs, meaning that when we consider the areas of relatively easy access to parishes, we expect to find a higher rate of parishes for those areas with a higher index of multidimensional poverty. The null hypotheses can be rejected at the EC and ADPI levels even when controlling for the most important predictor of parishes, which is the percentage of Catholics. Thus, when measuring poverty through the aggregated poverty index, there is evidence for the option for the poor at the level of ECs and ADPIs.

However, we cannot reject the null hypotheses at any other level of aggregation of

the data. This is due to the different distributions of the values at different levels of aggregation of the data. Considering that the null hypothesis cannot be rejected at the level of MxHCGUs or the level of the areas of reference, we can guess that although ECs with a higher index of poverty have more parishes, such parishes are not actually located in the areas with a higher poverty index. We also learn from the HLM that the distribution of the index of poverty at the level of MxHCGUs is not correlated to the number of parishes by EC.

Deprivation of Material Goods

I mentioned that limited income or deprivation of material resources has been a traditional measurement of poverty in economics. We use the deprivation of some material assets as the proxy to measure this dimension of poverty. We formalized the null hypotheses about this dimension of poverty as:

- H_{01}: The number of parishes is negatively, or not, correlated to the percentage of households without material possessions (such as a car, washing machine, refrigerator, phone, cell phone, internet access, computer, television, or radio).

From such statement, this is the alternative hypothesis:

- H_{A1}: The number of parishes is positively correlated to the percentage of households without material possessions.

We can reject the null hypothesis at the level of ECs. Material deprivation seems a strong predictor of the number of parishes. Even when controlling for the percentage of Catholics, the relationship is not removed. The model shows some spatial autocorrelation but the relationship remains statistically significant when we also control for neighbors. Therefore, we expect a higher rate of parishes where more people live deprived of

material goods. In similar terms the null hypothesis can be rejected at the level of ADPIs and the relationship also remains when controlling for neighbors and for the percentage of Catholic proportion. Therefore, we find, on average, more parishes located in poor areas than in areas with less material poverty. In sum, when we consider the dimension of poverty referred to as the limited possession of material goods, there is evidence for the option for the poor at the level of EC's and ADPIs.

At the level of MxHCGUs we cannot reject the null hypothesis. The addition of the percentage of Catholics in the models renders the coefficient significant. Adding the percentage of Protestants and the average value of neighbors removes the statistical significance (although the coefficient remains marginally significant).

When comparing all areas of reference, the areas without parishes have a significantly higher percentage of households in material deprivation than areas close to parishes, therefore we cannot reject the null hypothesis and we actually expect, on average, fewer parishes where there is more poverty. The HLM also shows a similar negative correlation, although it is not significant. We do not have any evidence of a priority provision of pastoral services to population living in material poverty at the level of MxHCGUs or when considering all the areas of reference.

Limited Access to Utilities

We would expect extended access to the advantages of modernity, at least in terms of having running water, but we find households deprived of it even in urban areas. Such dearth can be measured as a proxy of the deprivation of utilities and other advantages. The formal null hypothesis about this dimension of poverty states:

- H_{02}: The number of parishes is negatively, or not, correlated to the percentage of households without running water.

And the alternative can be formalized:

- H_{A2}: The number of parishes is positively correlated to the percentage of households without running water.

We cannot reject the null hypothesis at any level of aggregation. In fact, when controlling for other measurements of poverty, the negative association between this dimension of poverty and the number of parishes is significant at the level of ECs, MxHCGUs, and all areas of reference. The statistical significance is not removed by other controls. It seems that where there is more lack of infrastructure there are fewer parishes. This seems logical because parishes would take advantage of such infrastructure, but it contradicts the statement of the option for the poor because this is a dimension of poverty. Places deprived from basic services and utilities are also deprived from pastoral services.

We cannot find any evidence that the Catholic Church considers a priority the provision of pastoral services to people living in poverty in terms of deprivation of basic services and utilities. On the contrary, this population seems to have more limited access to pastoral services on average.

Deprivation of Health Services

We have not been able to measure health conditions in an appropriate manner, but the percentage of people not having the right to access government or private health services is a proxy for measuring health vulnerability. The null hypothesis about this dimension of poverty was formalized in these terms:

- H_{03}: The number of parishes is negatively, or not, correlated to the percentage of individuals without any health service plan.

Consequently, the alternative hypothesis states:

- H_{A3}: The number of parishes is positively correlated to the percentage of individuals without any health service plan.

We cannot reject the null hypothesis at the level of ECs, MxHCGUs, or ADPIs, as well as in the HLM. Nonetheless, we can reject the null hypothesis when considering all areas of reference together. This requires a closer observation of this dimension of poverty at different levels. We notice that the coefficient for the percentage with limited access to health services is positive and significant when we do not control for other variables at the levels of MxHCGUs and ADPIs; it is also positive but marginally significant at the level of ECs and positive although not significant in the HLM. When we control for other dimensions of poverty the significance is removed and even the sign changes, even becoming negative and significant at the ADPIs level. This dimension has a very similar distribution when comparing ADPIs and areas with no parishes. Due to this situation, when we include all areas of reference, we can expect a higher rate of parishes, on average, where more people have limited access to health services. Therefore, at this level we find that more pastoral services are provided where there is more health vulnerability.

We have statistical evidence that the Catholic Church provides more pastoral services to poor people in terms of health vulnerability when we aggregate all the areas of reference for our models. On the one hand, the evidence is limited because the aggregation of the data around areas without a parish is arbitrary and this dimension of poverty did not attain significance at any other level. On the other hand, when we use the most complete and detailed level of aggregation of the data, this dimension of poverty is the only significant priority of Catholic pastoral services.

Educational Disadvantages

Limited education is a commonly considered dimension of poverty. In this study it is measured by the proxy of illiteracy rate. Therefore, we have the following null hypothesis:

- H_{04}: The number of parishes is negatively, or not, correlated to the percentage of illiterate population aged 15 and more.

And the alternative would be:

- H_{A4}: The number of parishes is positively correlated to the percentage of illiterate population aged 15 and more.

At the level of ECs, we can reject the null hypothesis, as well as at the levels of MxHCGUs and ADPIs. If we look at all the areas of reference together, the coefficient is positive but marginally significant, and in the HLM it is not significant. The positive correlation that we find with 95% confidence reveals that more pastoral services correspond to lower levels of education, even controlling for the percentage of Catholics and the average of neighbors. Actually, the control for neighbors favors a stronger correlation at the level of ECs. Therefore, we can expect that there are more parishes, on average, where there are more people in educational disadvantage in ECs, MxHCGUs, and ADPIs.

The strongest evidence that we have found of the preferential option for the poor regards the dimension of poverty referred to as educational disadvantage. But although there is strong evidence that areas of limited education are a priority for pastoral services, we also know that the most disadvantaged areas in terms of education have a more limited exposure to pastoral services. Even if they are a minority of the population, 21% of Mexicans live in areas out of the direct pastoral influence of the Catholic Church, and the percentage of people who cannot read and write is 3.2 times higher in these areas than

the percentage of illiteracy among those living in ADPIs. Therefore this dimension in terms of priority of pastoral services is limited when considering the whole population in detail.

Ethnic Marginalization

The measurement of the percentage of people speaking an indigenous language works as a proxy for the measurement of marginalization due to ethnic identity, which is an important dimension of poverty in Latin America. In formal terms, we stated as null hypothesis that:

- H_{05}: The number of parishes is negatively, or not, correlated to the percentage of the population speaking an indigenous language.

And the alternative hypothesis is:

- H_{A5}: The number of parishes is positively correlated to the percentage of the population speaking an indigenous language.

This dimension of poverty is not prioritized by pastoral services. The coefficient is negative and significant at the level of ECs, MxHCGUs, and ADPIs. These results appear when we add all the dimensions of poverty, and also when the model includes only this dimension of poverty as the predictor, at the level of MxHCGUs or including all areas of reference. The coefficient is positive but not significant when we use the HLM and when we control for the percentage of Catholics using all areas of reference. Therefore, we do not find evidence of preferential pastoral service for the indigenous. On the contrary, we expect that indigenous ECs, MxHCGUs, and ADPIs, would have fewer parishes providing pastoral services, on average.

Therefore, we do not find evidence of the option for the poor in terms of ethnical marginalization. Moreover, we found some evidence that indigenous people are also

marginalized from the pastoral services offered by the Catholic Church as they have been measured in this research.

7.2. OTHER MAIN FINDINGS

Important Predictors of Pastoral Services

It is important to add some conclusions about the control variables we added in the models. In the first place, we can state that the main predictor of the incidence of parishes is the percentage of Catholics at every level and even in the HLM. This indicates a strong intra-church dynamic where Catholic majorities shape the decision of creating parishes. Of course, places with more parishes also tend to have higher percentages of Catholics. Although there is some endogeneity in this situation, the problem is not that bad because we use this variable only as a control. The percentage of Catholics and the number of parishes both measure dimensions of Catholicity, that is, the presence of the Catholic Church. However, we want to avoid the overestimation of the significance of the association between poverty and pastoral services. This will be the only way to identify if there is strong evidence of the option for the poor because the percentage of Catholics is the best control.

We have also discovered the relevance and meaning of the average number of parishes in neighboring areas. Against the common expectations in geo-statistics, the coefficient for the average outcome of neighbors is always negative and many times it is significant. This indicates that we do not usually find more parishes close to other places with a higher rate of parishes, but in the middle of areas with a lower number of parishes—or vice versa, fewer parishes are close to areas with more parishes. This spatial dispersion of parishes can be understood as evidence of an ecclesiastical strategy interested in reaching farther places. Although this is not evidence of the option for the

poor, it does reveal an interest for reaching the farthest and most isolated areas. However, this interest is limited by the urban infrastructure of the places where parishes are established, as I have already mentioned.

In the opposite direction, the control variable measuring the percentage of rural population, used in some models, was not as useful as I initially expected. It did not clarify the relationship between poverty and pastoral services because it appears as a parallel measurement of poverty. Since there is no statistical or theoretical reason for including this variable, it was not used as a control when dealing with smaller units of geographical aggregation.

Religious Competition

The percentage of Protestants was presented as an important control to take into account due to the common statement that the option for the poor is part of a strategy of religious competition. On the contrary, I found that the higher proportional presence of non-Catholic Christians is always negatively correlated to the number of parishes and it is not a strong control by itself at the levels of aggregation in this study. That was the reason for not adding it as a control variable in the models at the level of ADPIs and all areas of reference.

In Mexico, the percentage of Protestants is inversely associated with the proportion of Catholics and positively associated with measurements of religious diversity. This means that in Mexico diversity usually means the presence of other Christian non-Catholic groups in areas traditionally identified as Catholic. The lack of evidence of religious competition driving the option for the poor does not mean that the presence of Protestant churches is not related to poverty. The models eventually show some relationship between the percentage of Protestants and some dimensions of poverty.

The broader research agenda of PREC is also interested in testing if the Protestants have been prioritizing poor populations—somehow equivalent to an option for the poor—or if there is religious competition in poor areas. But in this study the only effect of religious competition that we want to control is its influence in the Catholic option for the poor in terms of pastoral service.

Therefore, I will leave for other subprojects the challenge of addressing the topic of the distribution of Protestants and the location of religious competition. For the meantime, I have not found evidence that the percentage of Protestants has any positive association with the number of parishes. This confirms my former statements mentioning that the Catholic environments and sectors more in favor of the option for the poor and liberation theology are not particularly engaged, in the present-day, in religious competition. Nevertheless, we should consider that this research design has not been made to explicitly focus on competition, but I only use the measurement of the percentage of Protestants as a control variable to better understand the relationship between poverty and pastoral services and in order to avoid spurious results overestimating a positive association between the measurements of poverty and the number of parishes.

In order to understand the Protestant presence among the poor, we would need to geocode Protestant churches and also aggregate data to identify the areas of influence. In terms of competition, it would probably be convenient to model the data at the level of localities after establishing a cutoff for excluding the smallest localities, which would only introduce noise in the analyses. We would also need a broader conceptual framework in order to include the understanding of Protestant churches about their missionary activity.

Levels of Geographic Aggregation of the Data

We have discussed that ECs and ADPIs are the two main levels of aggregation in terms of making sense of data on pastoral services. We also accepted that municipalities or sub-municipalities, as the MxHCGUs, are the best level for accessing and using socio-demographic data. In order to have some unit comparable to the ADPIs, we created areas of reference that make it possible to aggregate data for regions where there is no parish. These are not optimal units of analysis but they work in terms of comparison. This was the reason for not labeling them but simply calling them in general *areas of reference*.

We also decided to avoid modeling data at lower levels of aggregation in order to avoid spurious results only pulled up by the elevated proportion of zeros in the outcome.

We have found that the ADPIs are probably the best level of analysis because they can test if the option for the poor happens inside the ECs, thus showing the decisions and strategies of the bishops. Nonetheless, the ADPIs require an aggregation of data at the locality level as the starting point. ECs can show general trends in the Catholic Church, but they cannot show a detailed view. It is interesting that these two levels of aggregation are pretty consistent even if they are different in terms of size. It seems that dealing with levels that have a similar conceptual basis for the aggregation of the data minimizes, at least in this case, the Modifiable Areal Unit Problem (MAUP) of getting different results at the different levels.

The municipalities work well for socio-demographic data but do not make much sense in terms of pastoral priorities. They should be divided into sub-municipalities—MxHCGUs—in order to correspond to the ECs or to historical changes in municipal boundaries. Models at the level of MxHCGUs are limited in terms of understanding pastoral services. That was the reason for using the HLM to see if the variation at the municipality level could be a good predictor of outcomes at the level of the ECs.

The tool promises to be powerful when using historical data. In the cross-sectional analysis, the statistical significance of all dimensions of poverty is removed even before any control is added in the model. This happens because we need to adjust the value of the standard error, and the limited number of observations at the level of ECs (91) means that each standard error should increase 5.2 times its magnitude (or each *Z*-value is divided by 5.2). Therefore, the integration of more units of observation in the analysis would probably favor the significance of the coefficients, unless the units of analysis show a high variation across time.

7.3. SUMMARY OF FINDINGS AND PENDING TASKS

I have presented evidence not just about independent actors, as in former case studies about the social work of the Catholic Church, but about the distribution of parishes in Mexico in relation to different dimensions of poverty. I have considered outcomes related to official and practical policies and decisions from the highest levels of the Catholic hierarchy. I have also compared levels of aggregation which are meaningful for the organization and for understanding trends in the organizational behavior. In an existing debate about the relationship of the Catholic Church with the poor in Latin America, this research provides a model to evaluate how the preferential option for the poor is actually translated into pastoral policies.

The selected variables measure different dimensions of poverty. Therefore, in any unit of analysis, one of the measures could be high and the others could be low; many different combinations of values could happen. This complexity is added to the dissimilar distributions of the variables at the different levels of geographic aggregation of the data.

Therefore, I can answer the research question affirming that there is some evidence of the option for the poor in terms of pastoral services, but such option cannot

be found when observing every one of the five selected dimensions of poverty or when considering the different levels of aggregation of the data. More parishes in the poorest ECs are not strong evidence of the option for the poor in terms of decisions of the bishops, because each bishop makes decisions only for his own jurisdiction. Having more parishes located in poorer areas than in less disadvantaged locations actually indicates some option for the poor, although without longitudinal data it is difficult to know if the relatively poor condition of the area was a condition present before the erection of the parish or after. Therefore the evidence is not complete. In terms of material poverty or illiteracy, we can be highly sure of a positive association between these dimensions of poverty and a higher provision of pastoral services at the most relevant levels of aggregation. We can also be confident that there are more parishes in areas of reference with a lower percentage of the population having the right to access health services—thus with more health vulnerability. But we do not have enough evidence that this happens at higher levels of aggregation. On the contrary, we are also highly confident that indigenous areas and places of limited services and infrastructure are marginalized in terms of pastoral care. There is some evidence of the option for the poor, but not for the poorest and not for all dimensions of poverty.

As I have already mentioned, the main limitation of our research is the use of cross-sectional data. However, we cannot minimize the achievement in terms of having linked for the first time pastoral and socio-demographic data using comparable units of analysis. This research lays the foundation for more comprehensive research but the results are limited at this moment. Without the inclusion of time in our models, we do not know if there is some flow of causality. For example, the higher rate of parishes among those deprived of material resources or education could be the result of prioritizing them. However we would observe similar results if the places more attended by the Catholic

Church are more likely to reject ideas of progress or to avoid efforts for economic and educational improvement. In such case, the acceptance of their poverty as the will of God would be an effect of Catholic pastoral work and an active obstacle for overcoming their poverty. Longitudinal data will help to clarify the direction of causation or mutual causation, because we will observe what happened first. We know that circumscriptions are rarely suppressed in the Catholic Church; even more, in the case of Mexico, not even parishes are likely to disappear through time. Therefore, it is enough to determine the date of canonical erection of ECs and parishes in order to have a complete history of the expansion of centers of pastoral service. Once we have such information, the current structure of the data can be used for longitudinal analyses.

We have found some correlation of poverty and pastoral services. The Catholic Church has a potentially important role in alleviating poverty. The higher rate of parishes in small areas where people have more limited access to health services makes even more important the presence of Catholic clinics and of parishes having small doctors' offices and pharmacies in their facilities (*dispensarios*). But we still need to add historical data to better understand the conditions and the effects of pastoral services provided by the parishes to the poor.

We have not been able to find consistency in all the levels of aggregation of the data. We have not found consistency in most variables even in the two main levels in terms of historical research—the ECs and the MxHCGUs; however, we have explained that the reason for this situation is the different distribution of the predictors in relation to the outcome when comparing different levels of aggregation. Not one of the coefficients for the measurements of poverty was significant in the HLM regressions. These results indicate that we need to add more data in order to exploit the power of HLM and to see how the distributions of socio-demographic data, by ECs and by MxHCGUs, have

occurred longitudinally.

On the other hand, a main finding is that the levels for aggregating data on the provision of pastoral services (ECs and ADPIs) are pretty consistent with each other. This is important because, as I have explained, the ecclesiastical circumscriptions and the parishes are the most appropriate levels of analysis when doing research on pastoral priorities. They are the levels in which ecclesiastical policies are designed and those administrative units are the direct object of the decisions of ecclesiastical authorities.

The main challenges faced in this project have been gathering the data and linking them together to be able to perform analyses at different levels. The ways of facing the challenges constitute the main breakthroughs of this research. The methods make it possible to compare religious and civil data in the proper units of analysis and build an infrastructure to keep integrating historical data and making them eventually available to other researchers.

The process to get here has required major investments in time and effort. The results I show here are possible as part of the Project on Religion and Economic Change (PREC, see http://www.prec.com/) and the support of its director, Dr. Robert Woodberry. This research is a small part of the project and advances strategies for integrating more than a century's worth of data from different sources about Mexico. Longitudinal data will make possible more powerful and enlightening analyses, including tests of causation and mutual influence between different dimensions of poverty and different measurements of pastoral care. In PREC we have already gathered a huge amount of data and designed strategies to link civil and ecclesiastical data and to map socio-demographic and pastoral indicators using GIS.

The broader project and my research agenda include some important tasks that should be the next steps to follow up with this research:

- We need to keep subdividing the MxHCGUs in order to complete a set of historically consistent geographic units of analysis that correspond to the available data from more than a century. This is a very time consuming task, but it would be necessary for an accurate longitudinal analysis.
- We need to manually enter the data by municipality of Mexican census waves from 1895 to 1980 (we already have digital datasets from 1990).
- We need to validate and complete the cross-sectional data at the level of parishes. Once this dissertation is defended, my next immediate task includes organizing the first national parish pastoral survey in Mexico. The questionnaire has been designed to be answered by every pastor to gather data that will validate the exact location of the parish plus the identification of other churches depending on it, as well as the year of the creation—canonical erection—of the parish. This would make it possible to integrate the parish level in longitudinal research because parishes are not likely to disappear. The questionnaire will also ask for other services offered by the parish, mainly social services in terms of food, medical attention, formal and popular education, work training, and so forth. It would even be possible to gather some data that could be compared to the National Congregations Study (Chaves & Anderson, 2008).
- Once Catholic data are completed, it is worth integrating other data I have been gathering in PREC about the evolution of ECs and about the different affiliations of the bishops, distinguishing in terms of secular and regular clergy, and even identifying some groups of regular clergy such as Franciscans, Jesuits, etc. We have also organized historical data in terms of the number of secular priests as well as religious priests and religious sisters, who are the main agents providing services in a circumscription. Regular clergy and sisters do not depend on any

particular circumscription for their distribution at the national and international levels because they have their own organizations. This would allow us to measure pastoral priorities at levels other than the ECs and to test to what extent different religious communities give greater priority to the option for the poor.

There is already prospective use of the results presented here. The Mexican Episcopal Commission of Social Pastoral wants to take advantage of my findings in their own analyses and to keep using PREC's maps—which are now more accurate—in their publications. The Secretary of the Latin American Conference of Bishops is interested in using the research design for other countries of Latin America in order to evaluate the relationship of pastoral work with social, economic, and demographic conditions. Therefore, the results can be influential for social policies of the church and strategies of other organizations willing to have religious based organizations (RBOs) as allies for the achievement of social policies. The final goal is that my findings could, somehow, contribute to the improvement of the life conditions of those people living in poverty and, sometimes, in extreme poverty.

Appendices

Appendix A: Ecclesiastical Provinces and Circumscriptions

Name of Province/Circumscription	N of MxHCGUs	N of Localities	N of Parishes	Total Population
01 PROVINCIA ECLESIÁSTICA ACAPULCO	**87**	**7,788**	**214**	**3,458,323**
Arquidiócesis de Acapulco	21	2,224	74	1,469,494
Diócesis de Chilpancingo-Chilapa	29	2,010	85	1,143,865
Diócesis de Ciudad Altamirano	17	2,418	28	477,536
Diócesis de Tlapa	20	1,136	27	367,428
02 PROVINCIA ECLESIÁSTICA BAJA CALIFORNIA	**14**	**7,876**	**209**	**4,043,350**
Arquidiócesis de Tijuana	3	993	94	1,739,507
Diócesis de Ensenada	1	1,709	26	466,814
Diócesis de La Paz	5	2,850	40	637,026
Diócesis de Mexicali	5	2,324	49	1,200,003
03 PROVINCIA ECLESIÁSTICA BAJÍO	**56**	**10,680**	**354**	**6,766,990**
Arquidiócesis de León	10	2,624	114	2,188,637
Diócesis de Celaya	12	2,794	68	1,389,857
Diócesis de Irapuato	9	1,933	64	1,215,421
Diócesis de Querétaro	25	3,329	108	1,973,075
04 PROVINCIA ECLESIÁSTICA CHIAPAS	**118**	**19,851**	**158**	**4,776,987**
Arquidiócesis de Tuxtla Gutiérrez	43	7,205	65	1,634,753
Diócesis de San Cristóbal de Las Casas	48	7,484	52	2,020,911
Diócesis de Tapachula	27	5,162	41	1,121,323
05 PROVINCIA ECLESIÁSTICA CHIHUAHUA	**68**	**12,196**	**228**	**3,399,519**
Arquidiócesis de Chihuahua	20	2,747	73	1,191,284
Diócesis de Ciudad Juárez	4	371	69	1,349,193
Diócesis de Cuauhtémoc Madera	13	1,984	26	303,867
Diócesis de Nuevo Casas Grandes	6	680	23	133,122
Diócesis de Parral	14	2,017	20	251,315
Diócesis de Tarahumara	11	4,397	17	170,738
06 PROVINCIA ECLESIÁSTICA DURANGO	**61**	**7,491**	**224**	**3,398,942**
Arquidiócesis de Durango	31	2,839	77	1,131,253
Diócesis de Gómez Palacio	11	991	38	577,860
Diócesis de Mazatlán	7	1,327	43	652,569
Diócesis de Torreón	5	726	51	926,434
Prelatura de El Salto	7	1,608	15	110,826
07 PROVINCIA ECLESIÁSTICA GUADALAJARA	**184**	**18,192**	**786**	**10,399,891**
Arquidiócesis de Guadalajara	53	3,734	358	5,372,117
Diócesis de Aguascalientes	19	2,846	95	1,408,277
Diócesis de Autlán	18	1,303	43	310,043
Diócesis de Ciudad Guzmán	23	1,107	50	415,775
Diócesis de Colima	19	1,810	60	719,686
Diócesis de San Juan de los Lagos	21	2,956	78	755,135
Diócesis de Tepic	23	2,256	85	1,313,458
Prelatura de El Nayar	8	2,180	17	105,400

Name of Province/Circumscription	N of MxHCGUs	N of Localities	N of Parishes	Total Population
08 PROVINCIA ECLESIÁSTICA HERMOSILLO	**80**	**11,303**	**224**	**4,526,289**
Arquidiócesis de Hermosillo	33	3,172	71	1,359,297
Diócesis de Ciudad Obregón	36	3,613	74	1,051,800
Diócesis de Culiacán	11	4,518	79	2,115,192
09 PROVINCIA ECLESIÁSTICA MÉXICO	**111**	**4,832**	**766**	**14,513,978**
Arquidiócesis de México	17	548	451	8,851,414
Diócesis de Atlacomulco	17	1,061	63	1,005,862
Diócesis de Cuernavaca	33	1,503	108	1,777,226
Diócesis de Tenancingo	13	567	30	392,559
Diócesis de Toluca	31	1,153	114	2,486,917
10 PROVINCIA ECLESIÁSTICA MONTERREY	**129**	**15,743**	**484**	**9,742,806**
Arquidiócesis de Monterrey	29	1,926	180	4,295,324
Diócesis de Ciudad Victoria	20	2,734	31	523,814
Diócesis de Linares	15	2,753	24	288,707
Diócesis de Matamoros	8	2,418	55	1,369,889
Diócesis de Nuevo Laredo	11	776	38	489,555
Diócesis de Piedras Negras	16	1,319	30	557,318
Diócesis de Saltillo	19	1,828	63	1,265,750
Diócesis de Tampico	11	1,989	63	952,449
11 PROVINCIA ECLESIÁSTICA MORELIA	**128**	**10,581**	**444**	**4,997,755**
Arquidiócesis de Morelia	56	3,794	234	2,618,706
Diócesis de Apatzingán	11	1,525	27	330,536
Diócesis de Ciudad Lázaro Cárdenas	7	1,647	24	395,161
Diócesis de Tacámbaro	14	2,117	40	324,576
Diócesis de Zamora	40	1,498	119	1,328,776
12 PROVINCIA ECLESIÁSTICA OAXACA	**495**	**9,550**	**247**	**3,524,620**
Arquidiócesis de Antequera Oaxaca	332	4,153	116	1,624,965
Diócesis de Puerto Escondido	51	1,663	30	562,895
Diócesis de Tehuantepec	53	1,553	46	641,330
Diócesis de Tuxtepec	15	935	28	420,389
Prelatura de Huautla	20	648	9	131,439
Prelatura de Mixes	24	598	18	143,602
13 PROVINCIA ECLESIÁSTICA PUEBLA	**332**	**7,322**	**453**	**6,615,513**
Arquidiócesis de Puebla	151	3,896	248	4,343,595
Diócesis de Huajuapan de León	93	1,245	73	369,967
Diócesis de Tehuacán	28	887	58	732,015
Diócesis de Tlaxcala	60	1,294	74	1,169,936

Name of Province/Circumscription	N of MxHCGUs	N of Localities	N of Parishes	Total Population
14 PROVINCIA ECLESIÁSTICA SAN LUIS POTOSÍ	**104**	**10,541**	**274**	**3,734,490**
Arquidiócesis de San Luis Potosí	22	2,367	104	1,528,472
Diócesis de Ciudad Valles	25	3,367	43	771,821
Diócesis de Matehuala	12	1,131	18	263,248
Diócesis de Zacatecas	45	3,676	109	1,170,949
15 PROVINCIA ECLESIÁSTICA TLALNEPANTLA	**61**	**1,344**	**618**	**11,123,077**
Arquidiócesis de Tlalnepantla	6	169	193	2,094,345
Diócesis de Ciudad Nezahualcóyotl	4	65	83	1,897,528
Diócesis de Cuautitlán	18	346	88	2,585,106
Diócesis de Ecatepec	2	8	95	1,819,815
Diócesis de Teotihuacán	8	253	41	683,662
Diócesis de Texcoco	9	172	62	1,197,200
Diócesis de Valle de Chalco	14	331	56	845,422
16 PROVINCIA ECLESIÁSTICA HIDALGO	**101**	**5,572**	**180**	**3,071,416**
Arquidiócesis de Tulancingo	49	2,560	94	1,697,220
Diócesis de Huejutla	23	1,545	42	515,239
Diócesis de Tula	29	1,467	44	858,957
17 PROVINCIA ECLESIÁSTICA XALAPA	**218**	**21,298**	**449**	**7,853,198**
Arquidiócesis de Xalapa	37	1,863	93	1,246,567
Diócesis de Coatzacoalcos	11	1,754	25	818,721
Diócesis de Córdoba	28	1,379	47	756,346
Diócesis de Orizaba	28	857	42	630,185
Diócesis de Papantla	26	2,429	54	1,031,920
Diócesis de San Andrés Tuxtla	30	4,000	58	919,804
Diócesis de Tuxpan	36	6,282	58	1,154,772
Diócesis de Veracruz	22	2,734	72	1,294,883
18 PROVINCIA ECLESIÁSTICA YUCATÁN	**143**	**9,776**	**311**	**6,342,199**
Arquidiócesis de Yucatán	106	2,506	146	1,955,577
Diócesis de Campeche	11	2,778	46	822,441
Diócesis de Tabasco	17	2,499	66	2,238,603
Prelatura de Cancún Chetumal	9	1,993	53	1,325,578
Grand Total	**2,490**	**191,936**	**6,623**	**112,289,343**

APPENDIX B: OUTPUT OF GWR (ECS, INDEX & COVARIATES)

```
Global Model

Residual df  =        88                                  No. of obs =        91
Pearson X2   =  12.30119                                  Deviance   =  9.535126
Dispersion   =  .1397863                                  Dispersion =  .1083537

Negative Binomial (k=1) distribution, log link, offset ln(POBTOT)
------------------------------------------------------------------------------
      NParrs |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   POBRindex |   .0100478   .0107025     0.94   0.348    -.0109287    .0310243
 PCATOLI_pct |   .0184842   .0113573     1.63   0.104    -.0037757    .0407442
       _cons |  -11.27985   .9644314   -11.70   0.000     -13.1701   -9.389602
  ln(POBTOT) |          1  (exposure)
------------------------------------------------------------------------------

Bandwidth = 730384.8                  Score = .
Bandwidth = 1180607.6                 Score = .
Convergence : Bandwidth = 955496.18

Running Monte Carlo simulation

Geographically Weighted Regression
Significance Tests for Non-Stationarity
--------------------------------------------------------------------------------
Variable           Si                  P-Value
--------------------------------------------------------------------------------
Constant           0.4404              0.038
POBRindex          0.0025              0.470
PCATOLI_pct        0.0049              0.042
--------------------------------------------------------------------------------
```

APPENDIX C: OUTPUT OF GWR (ECS, DIMENSIONS & COVARIATES)

```
Global Model

Residual df  =        84                                  No. of obs =        91
Pearson X2   =  9.301105                                  Deviance   =  7.901977
Dispersion   =  .1107274                                  Dispersion =  .0940712

Negative Binomial (k=1) distribution, log link, offset ln(POBTOT)
------------------------------------------------------------------------------
      NParrs |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 VSNBIEN_pct |   .0544483   .0513027     1.06   0.289     -.046103    .1549997
 VSNAGUA_pct |  -.0159931   .0163598    -0.98   0.328    -.0480578    .0160716
 PSINDER_pct |  -.0007771     .01349    -0.06   0.954    -.0272171    .0256629
 PANALFA_pct |   .0237909   .0493589     0.48   0.630    -.0729507    .1205325
 PHLINDG_pct |  -.0133589   .0176169    -0.76   0.448    -.0478873    .0211695
 PCATOLI_pct |   .0159316   .0121554     1.31   0.190    -.0078926    .0397558
       _cons |  -10.98803   1.021524   -10.76   0.000    -12.99018   -8.985877
  ln(POBTOT) |          1  (exposure)
------------------------------------------------------------------------------

Bandwidth = 730384.8                    Score = .
Bandwidth = 1180607.6                   Score = .
Convergence : Bandwidth = 955496.18

Running Monte Carlo simulation

Geographically Weighted Regression
Significance Test for Bandwidth
----------------------------------------
Observed           P-Value
----------------------------------------
 9.6e+05           0.000
----------------------------------------

Significance Tests for Non-Stationarity
------------------------------------------------------------------------------
Variable           Si                  P-Value
------------------------------------------------------------------------------
Constant           0.3751              0.130
VSNBIEN_pct        0.0227              0.030
VSNAGUA_pct        0.0052              0.200
PSINDER_pct        0.0047              0.010
PANALFA_pct        0.0047              0.900
PHLINDG_pct        0.0072              0.020
PCATOLI_pct        0.0051              0.110
------------------------------------------------------------------------------
```

APPENDIX D: OUTPUT OF GWR (MXHCGUS, DIMENSIONS & COVARIATES, 250KM)

```
Global Model

Residual df  =      2482                                No. of obs =      2490
Pearson X2   =  1305.984                                Deviance   =  928.8089
Dispersion   =  .5261819                                Dispersion =  .3742179

Negative Binomial (k=1) distribution, log link, offset ln(POBTOT)
------------------------------------------------------------------------------
      NParrs |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 VSNBIEN_pct |   .0135801   .0060901     2.23   0.026     .0016437    .0255164
 VSNAGUA_pct |  -.0043213   .0018428    -2.34   0.019    -.0079331   -.0007095
 PSINDER_pct |  -.0002928   .0020103    -0.15   0.884    -.0042329    .0036472
 PANALFA_pct |   .0093555   .0060134     1.56   0.120    -.0024305    .0211415
 PHLINDG_pct |  -.0052991   .0018769    -2.82   0.005    -.0089779   -.0016204
 PCATOLI_pct |   .0193931   .0073456     2.64   0.008      .004996    .0337903
 PNCATOL_pct |  -.0038284   .0111395    -0.34   0.731    -.0256615    .0180046
       _cons |  -11.11489   .7181416   -15.48   0.000    -12.52243   -9.707363
  ln(POBTOT) |          1  (exposure)
------------------------------------------------------------------------------

Running Monte Carlo simulation
..........

Geographically Weighted Regression
Significance Test for Bandwidth
----------------------------------------
Observed           P-Value
----------------------------------------
 2.5e+05           0.000
----------------------------------------

Significance Tests for Non-Stationarity
--------------------------------------------------------------------------------
Variable           Si                  P-Value
--------------------------------------------------------------------------------
Constant           1.6715              0.100
VSNBIEN_pct        0.0710              0.000
VSNAGUA_pct        0.0061              0.100
PSINDER_pct        0.0059              0.000
PANALFA_pct        0.0505              0.000
PHLINDG_pct        0.0126              0.000
PCATOLI_pct        0.0166              0.300
PNCATOL_pct        0.0375              0.000
--------------------------------------------------------------------------------
```

APPENDIX E: OUTPUT OF GWR (ADPIS LEVEL, INDEX & COVARIATES, 150KM)

```
Global Model

Residual df  =      2994                                  No. of obs =      2997
Pearson X2   =  2441.045                                  Deviance   =  1450.056
Dispersion   =  .8153123                                  Dispersion =  .4843207

Negative Binomial (k=1) distribution, log link, offset ln(POBTOT)
------------------------------------------------------------------------------
      NParrs |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   POBRindex |   .0180012    .002352     7.65   0.000     .0133914     .022611
 PCATOLI_pct |   .0253148   .0025121    10.08   0.000     .0203912    .0302384
       _cons |  -11.16105   .2251924   -49.56   0.000    -11.60242   -10.71968
  ln(POBTOT) |          1  (exposure)
------------------------------------------------------------------------------

Running Monte Carlo simulation

Geographically Weighted Regression
Significance Test for Bandwidth
----------------------------------------
Observed           P-Value
----------------------------------------
 1.5e+05           0.000
----------------------------------------


Significance Tests for Non-Stationarity
------------------------------------------------------------------------------
Variable           Si                  P-Value
------------------------------------------------------------------------------
Constant           2.7914              0.000
POBRindex          0.0474              0.000
PCATOLI_pct        0.0311              0.000
------------------------------------------------------------------------------
```

APPENDIX F: OUTPUT OF GWR (ADPIS LEVEL, DIMENSIONS & COVARIATES, 150KM)

```
Global Model

Residual df  =      2990                                  No. of obs =      2997
Pearson X2   =  2308.657                                  Deviance   =  1326.995
Dispersion   =   .772126                                  Dispersion =   .443811

Negative Binomial (k=1) distribution, log link, offset ln(POBTOT)
------------------------------------------------------------------------------
      NParrs |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 VSNBIEN_pct |   .0336828   .0066189     5.09   0.000       .02071    .0466556
 VSNAGUA_pct |    .000342   .0015505     0.22   0.825     -.002697     .003381
 PSINDER_pct |  -.0045312   .0016986    -2.67   0.008    -.0078603   -.0012021
 PANALFA_pct |   .0426987   .0053388     8.00   0.000     .0322349    .0531624
 PHLINDG_pct |  -.0124205   .0018025    -6.89   0.000    -.0159534   -.0088877
 PCATOLI_pct |   .0223153   .0025418     8.78   0.000     .0173334    .0272972
       _cons |  -10.96143   .2222266   -49.33   0.000    -11.39699   -10.52588
  ln(POBTOT) |          1  (exposure)
------------------------------------------------------------------------------

Running Monte Carlo simulation

Geographically Weighted Regression
Significance Test for Bandwidth
----------------------------------------
Observed           P-Value
----------------------------------------
 1.5e+05           0.000
----------------------------------------

Significance Tests for Non-Stationarity
------------------------------------------------------------------------------
Variable           Si                 P-Value
------------------------------------------------------------------------------
Constant           2.4190             0.000
VSNBIEN_pct        0.1301             0.000
VSNAGUA_pct        0.0229             0.000
PSINDER_pct        0.0109             0.000
PANALFA_pct        0.0879             0.000
PHLINDG_pct        0.0729             0.000
PCATOLI_pct        0.0265             0.000
------------------------------------------------------------------------------
```

APPENDIX G: MODELS OF POVERTY (BY AREAS OF REFERENCE, NO COVARIATES)

	Model G.1 (N = 24,940)	Model G.2 (N = 24,940)	Model G.3 (N = 24,940)	Model G.4 (N = 24,940)	Model G.5 (N = 24,940)	Model G.6 (N = 24,940)	Model G.7 (N = 24,940)
Poverty Index	-0.0096 ***						
Percentage of Households w/o Material Goods		-0.0148 ***					**-0.0203** ***
Percentage of Households w/o Running Water			-0.0066 ***				-0.007 ***
Percentage of People w/o right to Health Services				0.002 *			0.0035 ***
Percentage of Illiterate Population					-0.005 **		**0.0172** ***
Percentage of Indigenous Language Speakers						-0.0037 ***	-0.0018
Intercept	-9.522 ***	-9.601 ***	-9.566 ***	-9.736 ***	-9.617 ***	-9.632 ***	-9.755 ***
Over-Dispersion Parameter	0.075	0.074	0.075	0.063	0.070	0.068	0.067

Notes: † p ≤ .10 * p ≤ .05 ** p ≤ .01 *** p ≤ .001 (two tailed)

APPENDIX H: OUTPUT OF GWR (A OF R LEVEL, DIMENSIONS & COVARIATES, 150KM)

```
Global Model

Residual df  =     24932                                 No. of obs =     24940
Pearson X2   =  10843.71                                 Deviance   =  4973.686
Dispersion   =  .4349314                                 Dispersion =  .1994901

Negative Binomial (k=1) distribution, log link, offset ln(POBTOT)
------------------------------------------------------------------------------
      NParrs |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 VSNBIEN_pct |  -.0096366   .0043452    -2.22   0.027    -.0181531   -.0011202
 VSNAGUA_pct |  -.0065035   .0010578    -6.15   0.000    -.0085768   -.0044303
 PSINDER_pct |   .0044479   .0012555     3.54   0.000     .0019871    .0069087
 PANALFA_pct |  -.0042356   .0039291    -1.08   0.281    -.0119364    .0034653
 PHLINDG_pct |   .0011542   .0012533     0.92   0.357    -.0013023    .0036107
 PCATOLI_pct |   .0234472   .0018466    12.70   0.000     .0198279    .0270664
 P_RURAL_pct |  -.0016243   .0005353    -3.03   0.002    -.0026734   -.0005751
       _cons |   -11.4921   .1645474   -69.84   0.000    -11.81461   -11.16959
  ln(POBTOT) |          1  (exposure)
------------------------------------------------------------------------------

Running Monte Carlo simulation

Geographically Weighted Regression
Significance Test for Bandwidth
----------------------------------------
Observed           P-Value
----------------------------------------
 1.5e+05           0.000
----------------------------------------

Significance Tests for Non-Stationarity
--------------------------------------------------------------------------------
Variable           Si                  P-Value
--------------------------------------------------------------------------------
Constant           1.4239              0.000
VSNBIEN_pct        0.0585              0.000
VSNAGUA_pct        0.0078              0.000
PSINDER_pct        0.0087              0.000
PANALFA_pct        0.0319              0.000
PHLINDG_pct        0.0672              0.000
PCATOLI_pct        0.0137              0.000
P_RURAL_pct        0.0063              0.000
--------------------------------------------------------------------------------
```

APPENDIX I: CORRELATION TABLES OF PREDICTORS AND CONTROLS

Data by Ecclesiastical Circumscriptions (ECs)

n = 91

	Poverty Index	Percentage of Households w/o Material Goods	Percentage of Households w/o Running Water	Percentage of People w/o right to Health Services	Percentage of Illiterate Population	Percentage of Speakers of Indigenous Language	Total Population	Percentage of Catholics	Percentage of Protestants	Percentage of Rural Population
Poverty Index	1.000									
Percentage of Households w/o Material Goods	0.941	1.000								
Percentage of Households w/o Running Water	0.879	0.795	1.000							
Percentage of People w/o right to Health Services	0.622	0.421	0.460	1.000						
Percentage of Illiterate Population	0.963	0.898	0.860	0.564	1.000					
Percentage of Speakers of Indigenous Language	0.913	0.928	0.678	0.392	0.862	1.000				
Total Population	-0.262	-0.278	-0.312	-0.021	-0.312	-0.215	1.000			
Percentage of Catholics	-0.051	-0.091	-0.066	0.124	0.018	-0.120	0.029	1.000		
Percentage of Protestants	0.124	0.121	0.118	-0.059	0.080	0.189	-0.081	-0.941	1.000	
Percentage of Rural Population	0.809	0.803	0.820	0.356	0.854	0.686	-0.417	0.104	0.011	1.000

Data by Maximum Historically Consistent Geographic Units (MxHCGUs)

n = 2,490

	Poverty Index	Percentage of Households w/o Material Goods	Percentage of Households w/o Running Water	Percentage of People w/o right to Health Services	Percentage of Illiterate Population	Percentage of Speakers of Indigenous Language	Total Population	Percentage of Catholics	Percentage of Protestants	Percentage of Rural Population
Poverty Index	1.000									
Percentage of Households w/o Material Goods	0.833	1.000								
Percentage of Households w/o Running Water	0.612	0.422	1.000							
Percentage of People w/o right to Health Services	0.514	0.242	0.190	1.000						
Percentage of Illiterate Population	0.834	0.764	0.458	0.275	1.000					
Percentage of Speakers of Indigenous Language	0.834	0.734	0.218	0.205	0.698	1.000				
Total Population	-0.201	-0.181	-0.145	-0.080	-0.244	-0.138	1.000			
Percentage of Catholics	-0.180	-0.232	-0.107	0.062	-0.096	-0.229	-0.067	1.000		
Percentage of Protestants	0.234	0.281	0.108	-0.037	0.155	0.291	0.007	-0.928	1.000	
Percentage of Rural Population	0.382	0.449	0.288	0.095	0.433	0.261	-0.347	0.034	0.022	1.000

Data by Areas of Direct Pastoral Influence (ADPIs)

n = 2,997

	Poverty Index	Percentage of Households w/o Material Goods	Percentage of Households w/o Running Water	Percentage of People w/o right to Health Services	Percentage of Illiterate Population	Percentage of Speakers of Indigenous Language	Total Population	Percentage of Catholics	Percentage of Protestants	Percentage of Rural Population
Poverty Index	1.000									
Percentage of Households w/o Material Goods	0.793	1.000								
Percentage of Households w/o Running Water	0.670	0.394	1.000							
Percentage of People w/o right to Health Services	0.554	0.217	0.214	1.000						
Percentage of Illiterate Population	0.802	0.755	0.421	0.328	1.000					
Percentage of Speakers of Indigenous Language	0.801	0.755	0.276	0.182	0.662	1.000				
Total Population	-0.139	-0.122	-0.112	-0.060	-0.205	-0.072	1.000			
Percentage of Catholics	-0.093	-0.100	-0.105	0.079	0.012	-0.155	-0.103	1.000		
Percentage of Protestants	0.149	0.153	0.113	-0.050	0.053	0.215	0.051	-0.941	1.000	
Percentage of Rural Population	0.260	0.308	0.184	0.115	0.339	0.145	-0.230	0.192	-0.157	1.000

Data by Areas of Direct Pastoral Influence (ADPIs) and Other Areas of Reference

n = 24,940

	Poverty Index	Percentage of Households w/o Material Goods	Percentage of Households w/o Running Water	Percentage of People w/o right to Health Services	Percentage of Illiterate Population	Percentage of Speakers of Indigenous Language	Total Population	Percentage of Catholics	Percentage of Protestants	Percentage of Rural Population
Poverty Index	1.000									
Percentage of Households w/o Material Goods	0.759	1.000								
Percentage of Households w/o Running Water	0.636	0.259	1.000							
Percentage of People w/o right to Health Services	0.469	0.176	0.140	1.000						
Percentage of Illiterate Population	0.742	0.688	0.288	0.242	1.000					
Percentage of Speakers of Indigenous Language	0.766	0.705	0.151	0.123	0.623	1.000				
Total Population	-0.073	-0.060	-0.061	-0.014	-0.097	-0.040	1.000			
Percentage of Catholics	-0.212	-0.238	-0.113	-0.055	-0.112	-0.195	0.006	1.000		
Percentage of Protestants	0.230	0.258	0.096	0.056	0.132	0.238	-0.016	-0.928	1.000	
Percentage of Rural Population	0.173	0.167	0.158	0.011	0.206	0.091	-0.256	-0.040	0.047	1.000

APPENDIX J: MODELS OF POVERTY (ADPIS/OTHER AREAS, ALL CONTROLS)

	Model J.1 (N = 2,997)	Model J.2 (N = 2,997)	Model J.3 (N = 24,940)	Model J.4 (N = 24,940)
Poverty Index	-0.0028		-0.0079 ***	
Percentage of Households w/o Material Goods		-0.0044		-0.0132 ***
Percentage of Households w/o Running Water		-0.0018		-0.0058 ***
Percentage of People w/o right to Health Services		-0.0041 ***		0.0026 *
Percentage of Illiterate Population		0.0238 ***		0.0058 †
Percentage of Indigenous Language Speakers		-0.0052 ***		0.0005
Percentage of Catholics	0.0097 *	0.0049	0.0294 ***	0.0271 ***
Percentage of Protestants	-0.0017	-0.0076	0.0097	0.0084
Percentage of Rural Population	0.0184 ***	0.0172 ***	0.0001	0.0006
Intercept	-10.5 ***	-10.02 ***	-12.14 ***	-12.08 ***
Over-Dispersion Parameter	0.041	0.038	0.058	0.057

Notes: † p ≤ .10 * p ≤ .05 ** p ≤ .01 *** p ≤ .001 (two tailed)

APPENDIX K: URBAN/RURAL CORRELATION OF THE NUMBER OF PARISHES AND POVERTY

and …	N of Parishes in Rural Localities* (n = 188,284)	Correlation of N of Parishes in Urban Localities* (n = 3,651)	N of Parishes in Any Locality (n = 191,935)
Poverty Index	-0.0579	-0.1179	-0.0458
Percentage of Households w/o Material Goods	-0.0324	-0.0940	-0.0256
Percentage of Households w/o Running Water	-0.0816	-0.0942	-0.0525
Percentage of People w/o right to Health Services	-0.0125	-0.0557	-0.0144
Percentage of Illiterate Population	-0.0310	-0.1366	-0.0342
Percentage of Speakers of Indigenous Language	-0.0078	-0.0618	-0.0130
Percentage of Catholics	0.0332	-0.0020	0.0068
Percentage of Protestants	-0.0218	-0.0274	-0.0045
Total Population	0.2646	0.9424	0.9416

* A locality is considered urban when it has 2,500 inhabitants is or more.

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